AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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VOLUME 21. NEW YORK, THURSDAY, SEPTEMBER 1, 1898. NUMBER 35.

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The Horwich Shops of the Lancashire & Yorkshire Railway.—II.

Last week we gave a general plan and numerous cross sections showing the general arrangement and construction of these remarkable shops, and in this number are engravings made from photographs which give an excellent idea of their appearance internally and of the character of their equipment.

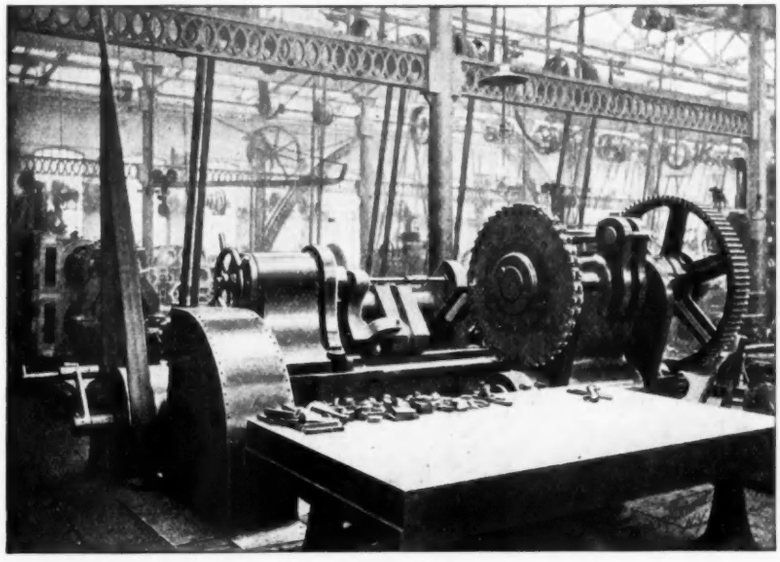

FIG. 18.—CRANK SWEEP MILLING MACHINE FOR LOCOMOTIVE AXLES.

Of these Fig. 18 shows a machine which is one of the boldest conceptions of the milling machine idea in existence. I do not know who is to be credited with the origination of it, for in the older shops at Crewe I saw machines essentially like it at work, and, later, at the great establishment of the Cockerill Company at Seraing, Belgium, I saw a machine embodying the same principles and which had been constructed in that establishment many years before for doing the same work. We have no use for such a machine here, because we do not do the work requiring it. The machine is for milling out the metal to form the cranks, and, roughly, the crank-pins also for the main driving axles of inside connected locomotives. Unfortunately the "setting out" plate in the foreground of Fig. 18 obstructs the view of the machine, but its general features can readily be made out. As these axles come from the forge the mass of metal which forms the two webs of a crank and the crank-pin is in one solid chunk, and, as our readers know, the usual practice in marine work is to drill through at the corners where the pin joins the webs and then slot out the piece, leaving the pin a more or less misshapen affair to be slowly reduced to form in the lathe. The large number of axles to be made all alike in locomotive work, however, justifies and in fact demands something better than this. The machine consists essentially of a bed having a head and a footstock between which the forging is swung on centers with suitable fixtures for the off-set and can be given a rotary feed motion when required. At the rear of the headstock (though in front of it in the view shown) is a swinging frame of very massive proportions, pivoted below as shown, carrying the tremendous milling cutter spindle at the top and arranged to feed the inserted tooth mill toward the work by means of a screw which takes hold of the swinging frame at the top, as shown. When the work is at first put into the machine it does not rotate, but is held still in such a position that the milling cutter, being fed in, cuts out the slot forming the crank-webs, and this feed automatically stops when the right depth is reached to leave enough metal to form the pin. The cutter arbor is then held in this position while the feed motion which revolves the axle on the centers, being thrown in, mills the pin so closely to size and shape that

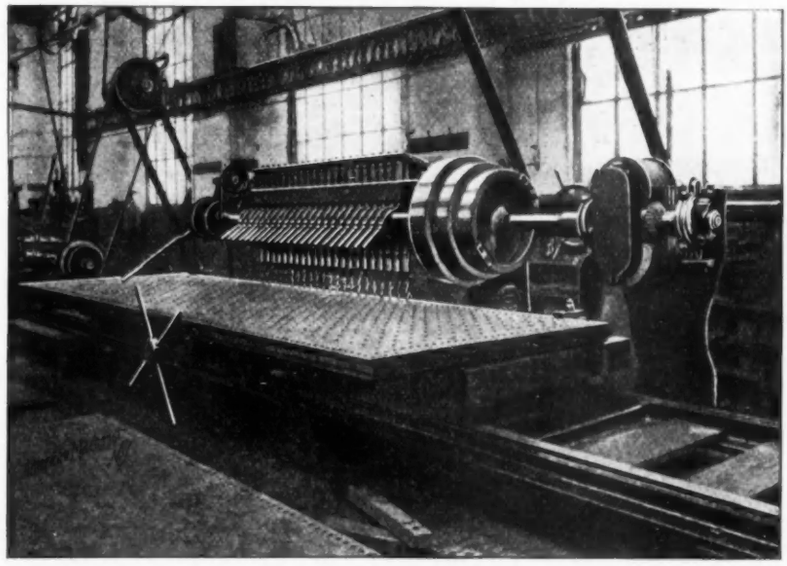

FIG. 19.—TWENTY-SPINDLE BOILER PLATE DRILLING MACHINE.

when the axle afterward goes to the lathe, only finishing cuts are required on the pins.

The inserted cutters resemble round nose planer tools and are given top rake, so that they may really cut, as, in fact, such tools usually do in European shops and not merely push off the metal as they usually do in our own shops. The machine, as may readily be imagined, is very efficient as compared with any other practiced method of removing the same metal.

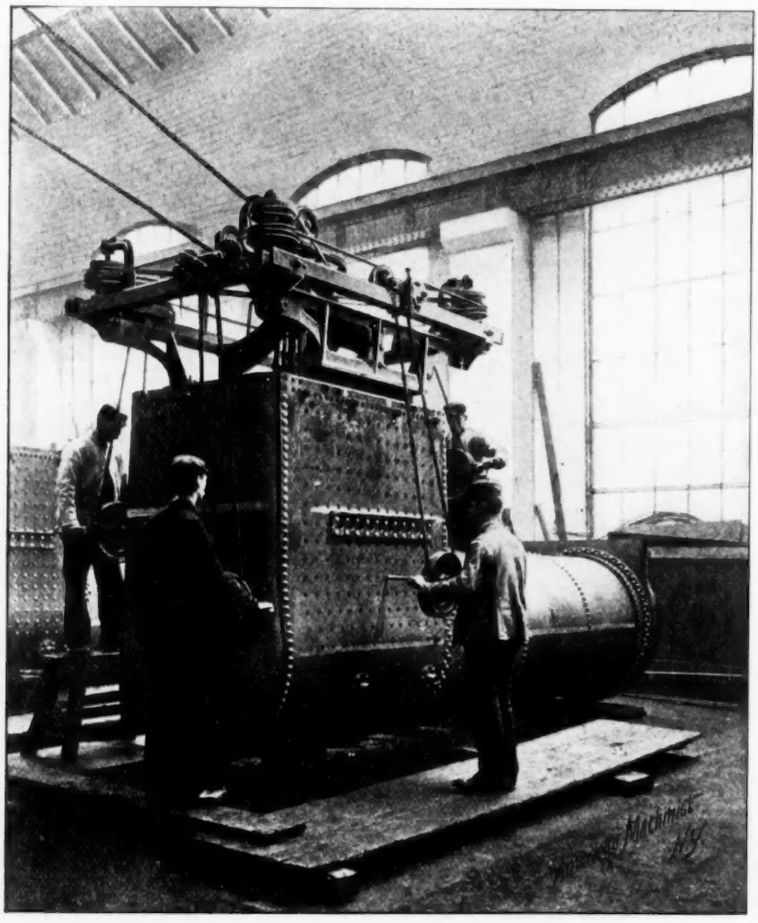

FIG. 20.—FIRE-BOX TAPPING MACHINE.

Fig. 19 is a twenty-spindle drilling machine for drilling boiler plates before bending, no boiler plates being punched in this establishment. In position on the machine will be seen five boiler plates and a template by which they are drilled, and it will be noticed that, though the machine appears to have been originally planned to be driven by belt, it is now driven by a direct-attached motor seen at the right.

At Figs. 20 and 21 a special machine for tapping stay-bolt holes in fire-boxes is seen. By means of this machine the four sides of the fire-box can all be tapped at the same time. The machine is picked up by a crane, placed over a fire-box, as shown, and fastened by bolts. Adjustable idlers permit a driving rope to be led from the nearest convenient pulley and each tapper is swung from a trolley, which permits free horizontal movement, while a system of counterweights, takes care of the slack rope and permits the necessary vertical movement.

Fig. 22 shows the 400-ton hydraulic flanging press with the furnaces, and in the foreground some smoke-box front plates that have been flanged.

Fig. 23 shows a form of steam hammer which so far as I know is not found in America. And it is at once obvious that it has advantages where there is likely to be trouble with the foundations for a vertical hammer or from the vibrations caused by it, or where head room is not available. I do not know that any of these considerations had influence in the choice of this particular machine, but I do know that the man who stands at the levers shown in front of it has complete control of the machine with a good and clear view of his work, and that when the two heavy hammers meet in the center, one each side of the work and each one resisting and absorbing the force of the equal blow delivered by the other, very effective work is done with very little fuss. It is rated as a 35-ton hammer, by which I suppose is meant that both the hammers and their pistons together weigh 35 tons.

Fig. 24 shows the method of riveting frames by a hydraulic riveter, and the latter is supported by what is called a "giraffe crane," which, as clearly shown, is constructed to run along the shop on a broad gage track and with an arch, which thus passes over anything which may be on the standard gage track—such as the driving wheels shown in the engraving, for instance.

At Fig. 25 is a view in the erecting and repairing shop. Four overhead traveling cranes are in view, each electrically driven and of 30 tons capacity.

At the left of Fig. 26, which is a view

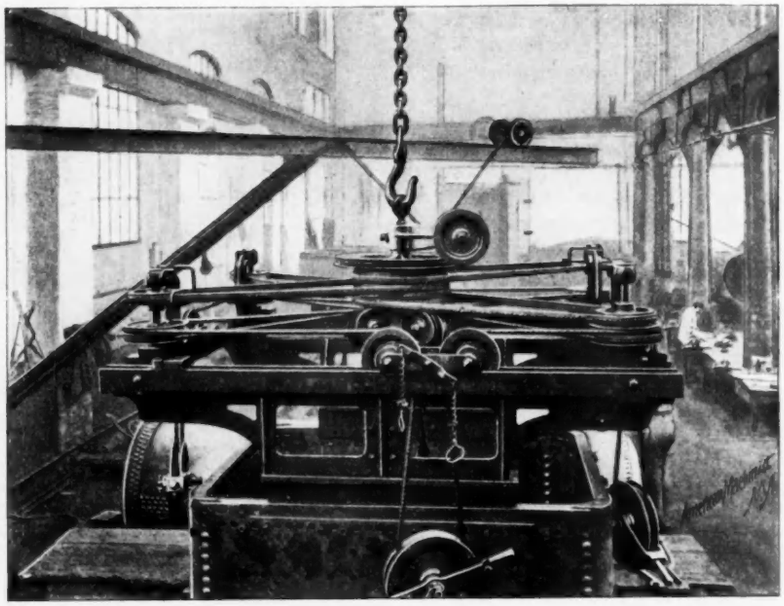

FIG. 21.—ANOTHER VIEW OF FIRE-BOX TAPPING MACHINE.

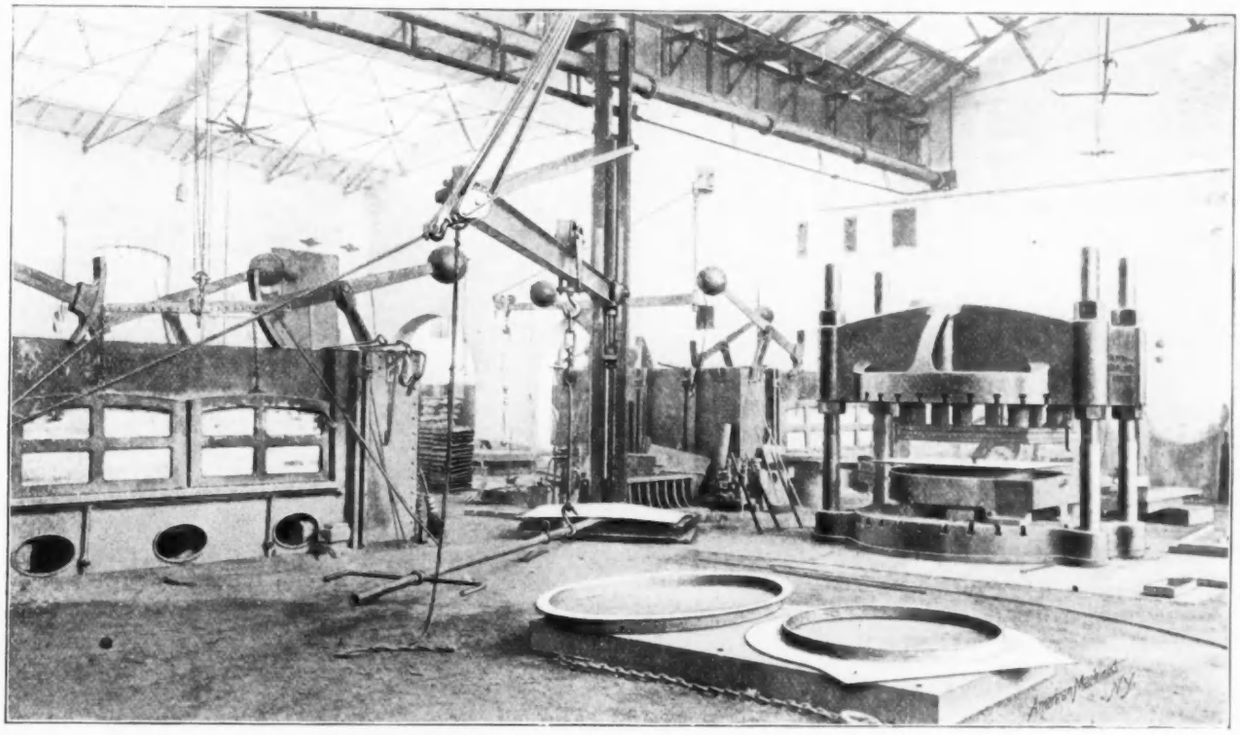

FIG. 22.—HYDRAULIC FLANGING PRESS AND HEATING FURNACE.

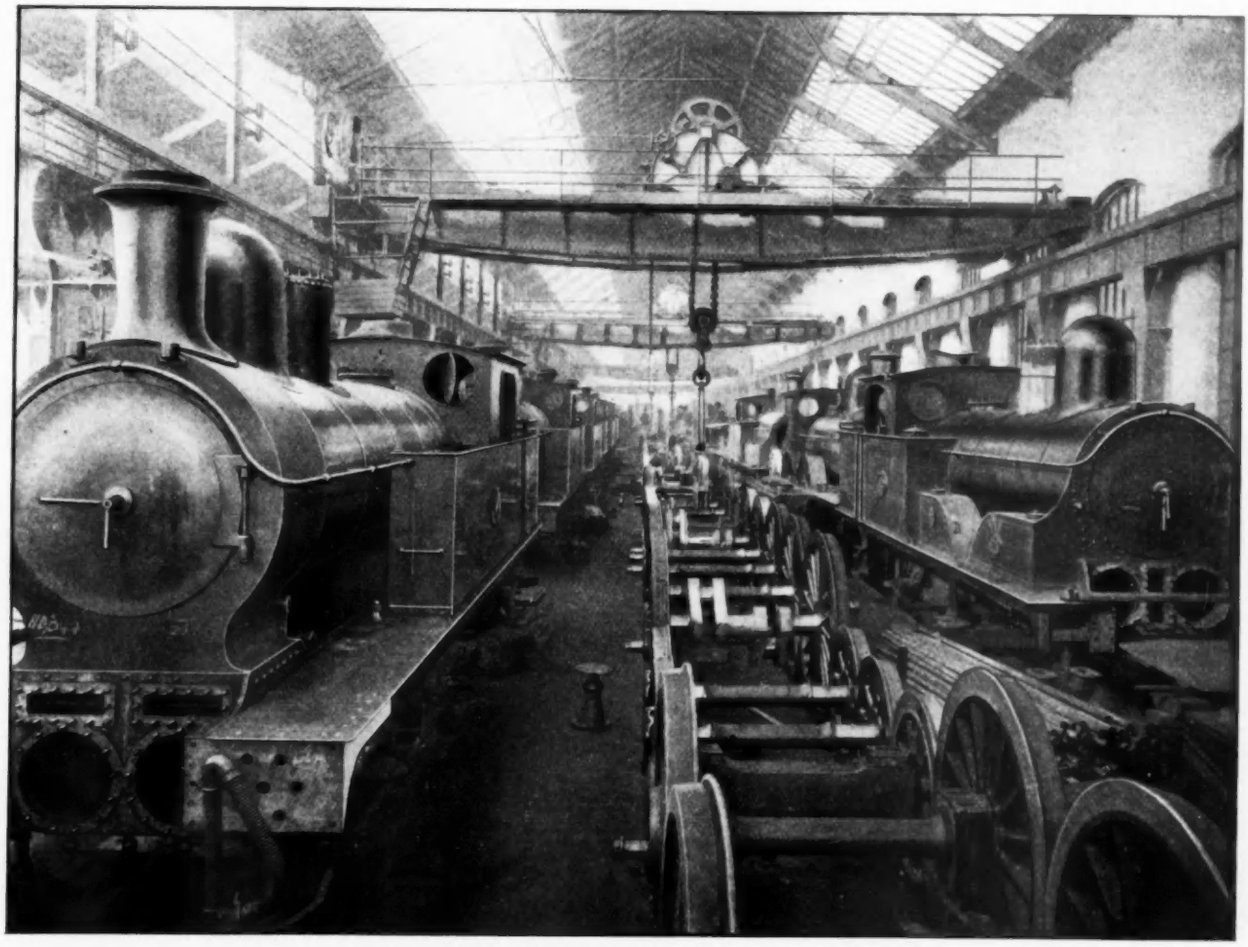

FIG. 25.—INTERIOR OF ERECTING AND REPAIRING SHOP.

of the erecting shop, a locomotive is seen suspended from two of the electric cranes and at the right there is an imposing array of vises. These do not, however, indicate that a proportionately great amount of vise work is done on the engines, but they are placed thus close together throughout the length of the shop so that a man working on any portion of the floor will never have far to go to reach a vise in case he needs to use one.

Fig. 27 is a view of one bay of the machine shop, in the left foreground of which are seen the vertical spindle milling machines for finishing rods and at the right the special machines for cylinders. Down the center runs the single rail upon which is supported the "walking crane," which is rope driven and is used in transporting material from one machine to another. These cranes are shown also in the sectional view, Fig. 10. On each side of this crane rail are the gratings before referred to, under which are the steam pipes for heating. There are three of these bays 508 feet long and with a combined width of 111 feet. At the top can be seen the white disks by which the light from the arc lamps is diffused and the formation of deep shadows avoided.

Figs. 27 and 28 show the narrow gage railway before referred to in operation, the first of these being a train of "tipping wagons" and the other a boiler mounted on trucks especially designed for the purpose. This road, as previously stated, is supplementary to the one of standard gage. It is 18-inch gage and is 6½ miles long.

The methods pursued in finishing cylinders in this shop are unique and interesting, and some account of them will be given next week. F. J. M.

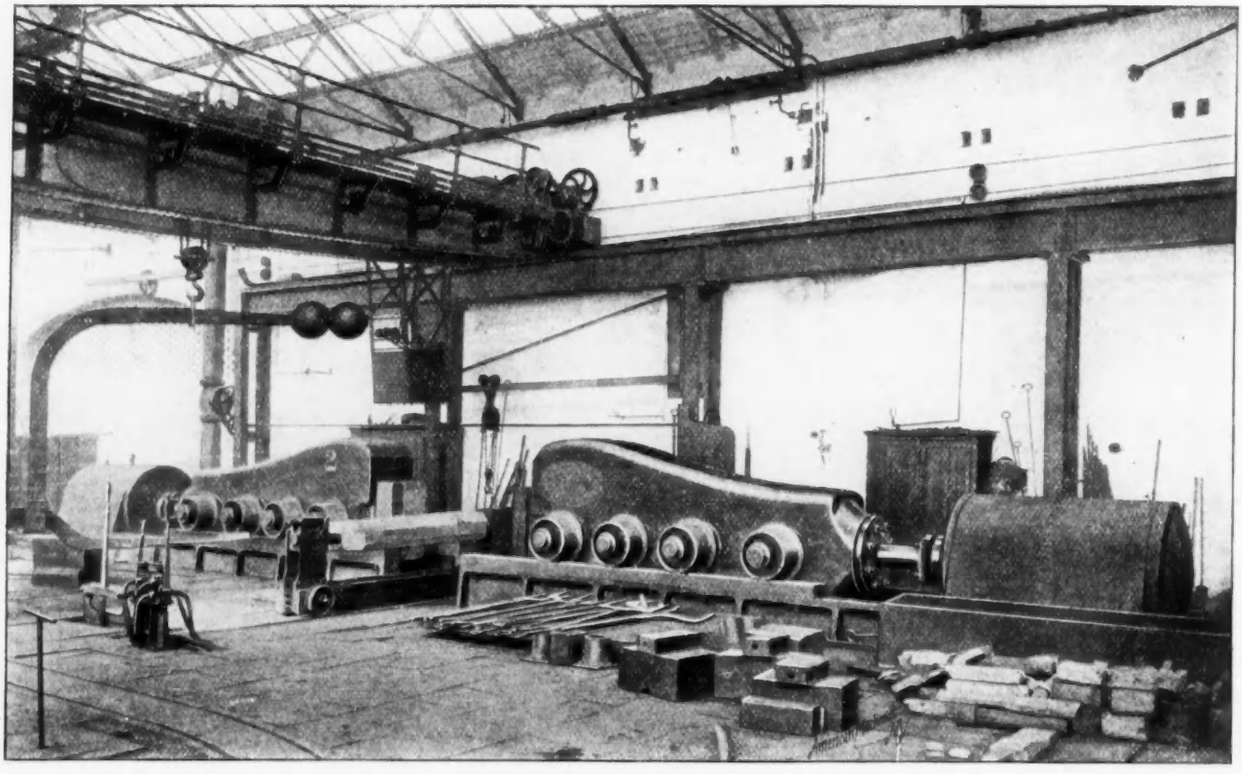

FIG. 23.—DUPLEX HORIZONTAL STEAM HAMMER.

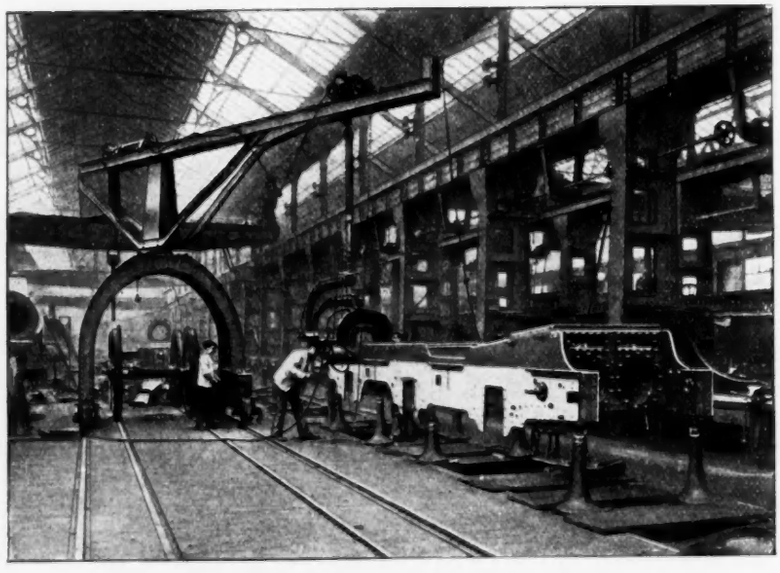

FIG. 24.—HYDRAULIC RIVETER FOR FRAMES.

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The Bethlehem Iron Company, South Bethlehem, Pa., has been asked to bid on the forgings for the engine and shafting of a torpedo boat to be built in Japan for the Imperial Japanese Navy. The line of shafts, including the thrust and crank shafts, are to be hollow.

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Perhaps the largest lead-lined tank in the world is that constructed for the naval spectacle at Madison Square Garden, in this city. It is 266 feet long, 115 feet wide and 4 feet deep, with two smaller side tanks. About 70 tons of lead and 5 tons of solder were used. Forty-five plumbers and eighty-five laborers made it in five days.

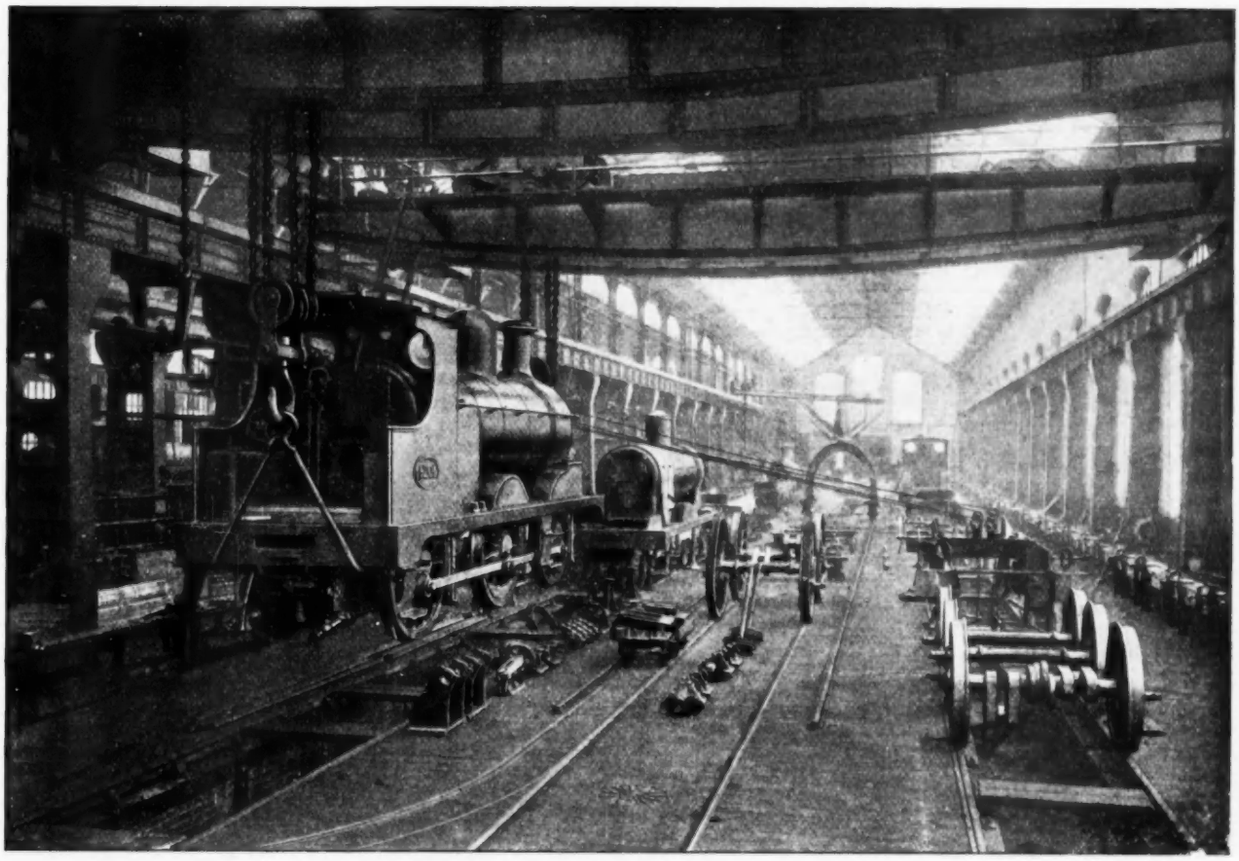

FIG. 26.—INTERIOR OF ERECTING SHOP.

FIG. 27.—A BAY OF THE MACHINE SHOP.

Steam Boiler Practice in England.

A paper upon "The Generation of Steam," read before the Municipal Electrical Association (England) by J. J. Steinitz, contains much information of special interest to American engineers, setting forth, as it does, the most advanced Trans-Atlantic practice. We cannot make make room for the entire paper, but present its essential points, and generally in their original form.

The efficiency and economy of the generation of steam are dependent on: (1) the type of boiler, (2) the fuel, (3) the water, (4) the stoking arrangements, (5) adjuncts to the boiler, such as economizers, feed heaters, superheaters and forced draft. The types most commonly in use in electric lighting in England are Lancashire boilers, tubular boilers of the Babcock & Wilcox type and marine boilers.

Some Lancashire boilers have cross tubes and many are without them. The author cannot come across any evaporation tests of two Lancashire boilers, one fitted with cross tubes and one without, except when the boiler with tubes was new and the one without old. Naturally the new boiler with the tubes came out the better. The circulation of water in this type may not be so good as in the multi-tubular boiler, but there is no reason why a circulator should not be fitted, and the circulation, and consequently the efficiency, increased. Such a fitting is used at the present time for cleaning purposes. Whether or not it is a success as a cleaner I do not know, but from experiments witnessed the circulation was certainly improved. Good circulation is

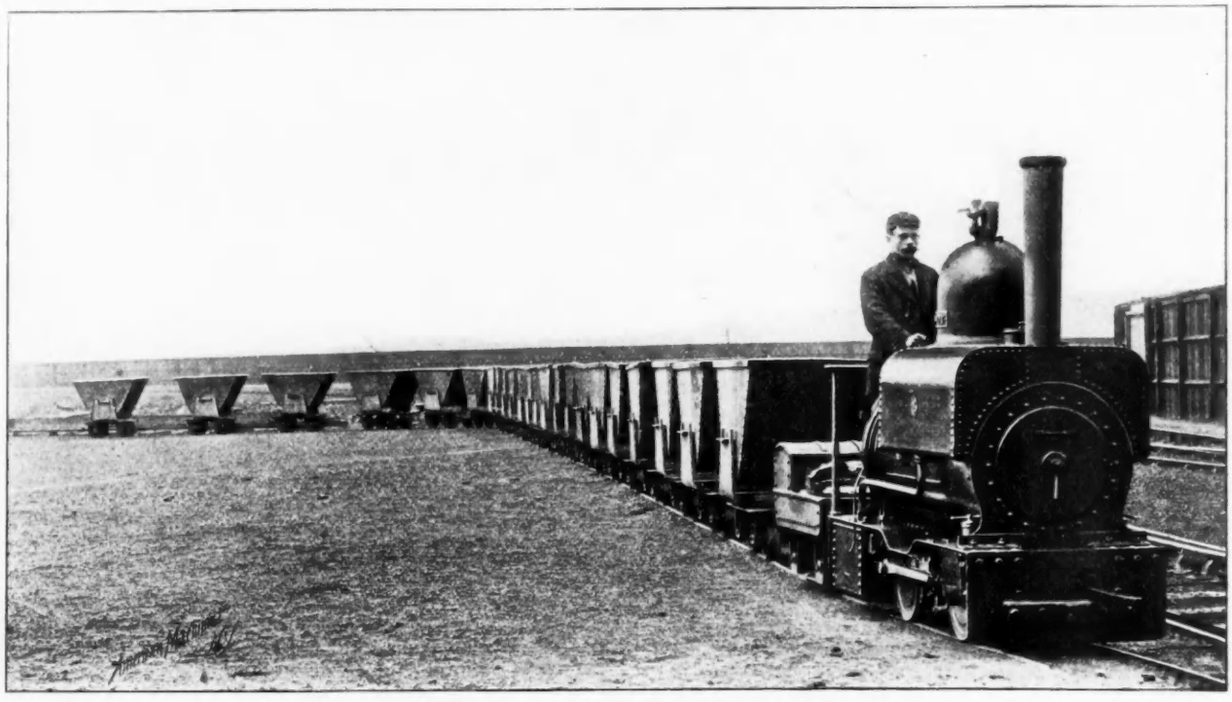

FIG. 28.—A VIEW OF THE NARROW GAGE WORKS RAILWAY.

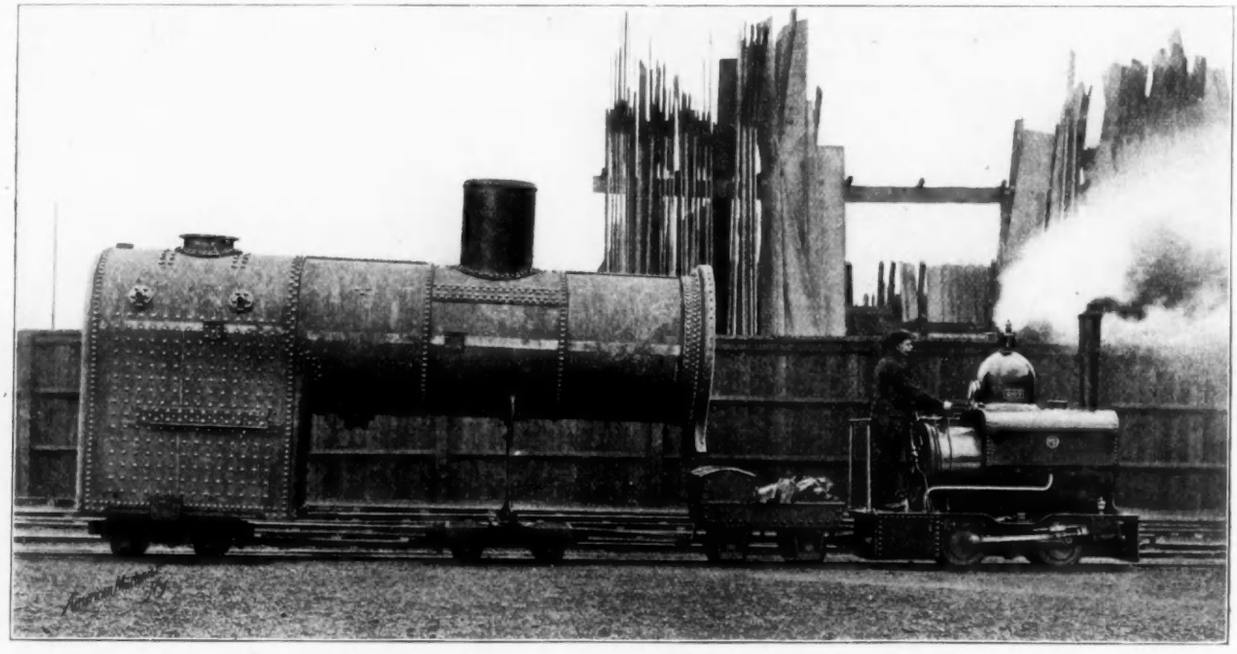

FIG. 29.—ANOTHER VIEW OF NARROW GAGE RAILWAY.

the salvation of a boiler. It is governed to some extent by the working pressure; consequently the water tube type has had the advantage. With bad circulation there is a loss of economy, due to an increased temperature of the heating surfaces, which leads to the rapid deterioration of the boiler.

The question of the pressure at which a Lancashire boiler may be worked is of importance, and it is noteworthy that quite recently one large firm, builders of this type, advised the use of tubular boilers for all pressures over 120 pounds. As regards the life of this boiler, so much depends on the nature of the feed water used and the care taken in cleaning, etc., that any stated time might be misleading. With good water and ordinary care the average life of this type is about twenty years, without any reduction in the working pressure being called for or necessary. With tubular boilers of the Babcock & Wilcox type the pressure can be raised considerably above that usually carried in Lancashire boilers. As to the life, it can hardly be given, as a few tubes will at times make it practically as good as new. The repairs and maintenance of this boiler will in most cases be considerably in excess of the amount spent on a Lancashire boiler. Cleaning is a longer job, and the chances of trouble or an accident from a defective joint are considerably increased as between the seventy or eighty joints on a Babcock & Wilcox and the one or two joints on a Lancashire boiler. The circulation is very good, and the evaporation per pound of fuel consumed very high; in fact, I think the highest ever obtained except by the Thorneycroft boiler, as used on some of the torpedo boats built by that firm. The boiler takes up little room for the work it does, though it must be remembered that the distance for drawing the tubes should be debited to the account of the space allowed for it. Many conflicting statements have been made in favor of and against the Babcock & Wilcox boiler for intermittent use. That there is more loss in cooling down in a Babcock & Wilcox than from a Lancashire boiler the author thinks is true, owing to the large radiating surface of brickwork inclosing the former. This, however, may be more than compensated for by the ease with which steam is raised in the former.

The marine boiler has proved an unqualified success wherever it has been adopted. The average life would be rather less than that of the Lancashire boiler, owing to the difficulty in cleaning it. Many are the efforts made by engineers to stop either pitting or scale forming on the tubes and plates. One arrangement struck the author as being rather neat—at least in theory. A small alternating machine was driven by a strap from the propeller shaft. From one terminal a wire was carried through the shell of the boiler, but insulated from it, and was fastened to two rods at a point above the water line. The rods were bolted to two plates about the center of the hight of the water. The plates were kept in position by clamps insulated from the shell of the boiler. The other terminal of the machine was connected to earth. The effect of the current was to electrolyze a small part of the water. The hydrogen would follow the course of the current, and be deposited on the shell of the boiler and the flue tubes. When the current changed, oxygen would be produced. The two would combine and produce a thin film of chemically pure water, which would hinder the deposit upon the shells and tubes. Another plan the author has seen adopted at sea is to give the inside of the boiler a good coating of coal tar. He has known this tried on boilers on land, with the result that instead of cleaning the boilers every three weeks, every eight weeks was quite sufficient. Many engineers hold that it is as important that the products of combustion in their course to the shaft should be brought into contact with all the heating surface, as that there should be a good circulation of water. Should this be so, no boiler he is acquainted with fulfills the conditions better than one of the ordinary marine type.

Fuel.—The theoretical value of various fuels can be found in many pocket books. One must be guided by the locality in which the steam has to be generated, and that controls the cost.

Feed Water.—In all cases, and whatever boiler may be in use, it is undoubtedly necessary to have good water. In many districts the water has to be treated, and it most certainly pays the user of steam to have this treatment effected outside the boiler. Boiler compositions may be good; they may also do more damage to the boilers than good to the water, but whatever is done to the water the author's point is that it should be done outside the boiler. If surface condensers are used a certain amount of oil will get into the water, and if not dealt with carefully will most probably play havoc with the boiler. This will be the result with all boilers, though probably an accident would be more likely to happen with a boiler of the tubular type. A coke filter, used intelligently, will be found to be all that is required.

Stoking Arrangements.—The main question at first is hand firing versus mechanical stoking, but after one has made up one's mind to the advantages of the latter system, which, with the exception of a few special cases, is inevitable, one is met with the question of coking versus sprinkling stokers. One advantage accruing from the use of mechanical stokers is immunity from creating a smoke nuisance. That a smoke nuisance may be avoided by very careful hand firing and the use of the best coal is admitted, but it is almost impossible to get three shifts of careful stokers, and almost as difficult to get an engineer to continue buying the best coal if he can struggle through on an inferior quality, while with mechanical stokers the commonest slack can be used with advantage, with no prospect of trouble, and there will be a large reduction in the coal bill. The reason for the economy of fuel is partly due to the fire being always clear. Again, not only do you get better results from your boilers, but the economizer is more efficient and the flue gases do not carry so much smoke with them, so that the greatest heat is obtained in the furnace. That economy in fuel does really exist is best brought to your notice by quoting the following tests:

Duration of trial	10 hours	10 hours
Description of fuel used	Small slack	Small slack.
Price of fuel used	About 6s. ($1.50) per ton	About 6s. ($1.50) per ton
Fuel consumed per hour	492.8 lbs.	588 lbs.
Water evaporated per hour	415 gallons	624 gallons.
Temperature of feed water	70° Fahr.	70° Fahr.
Steam pressure	50 lbs.	50 lbs.
Water evaporating per pound of fuel from and at 212° Fahr.	9.87 lbs	12.43 lbs.
Cost of evaporating 500 gallons	1/4.2—32.4 c.	1/0.9—25.8 c.

With a mechanical stoker and conveyor properly arranged one man can attend to the firing of five boilers, and with two furnaces each. With hand firing it is also impossible to get more than four furnaces attended to by the very best of stokers. The saving therefore in stoking five boilers mechanically would be three men's wages against seven men's, a saving of £6 ($30) per week. Against this there is the cost of working the mechanical stoker, 3s. per week; the interest and sinking fund on the outlay, 17s. 10d. per week, and the repairs and maintenance of the stokers, 13s. 5d. per week, or a saving of £4 5s. 9d. ($21.50) per week, independently of any saving by the use of cheaper fuel. The difference between Vicars, which is a good example of the coking stoker, and the Bennis, which is a good example of the sprinkling stoker, lies in the fact that the former machine pushes the coal on at the front end of the fire-grate, and gradually carries the fuel to the back end. There is, therefore, a great mass of incandescent fuel at the front, the fire gradually tapering down to nothing at the back end. In the latter the fire is kept level, as it ought to be in hand firing, and the coke thrown on in small quantities, each time in a different place, thus approximating as nearly as possible to perfect hand firing. With the former machine the boilers cannot be forced rapidly; with the latter machine the amount of coal burned can be adjusted from 15 pounds to 50 pounds per square foot of grate per hour, thus giving the necessary margin to meet sudden demands of steam. Further, the following

tests—there are many others of a similar nature—may assist one in making up one's mind as to the advisability of adopting a coking or a sprinkling stoker:

HAND FIRING *vs.* MECHANICAL STOKING.

	Coking Stoker. (Vicars.)	Sprinkling Stoker. (Bennis.)
Duration of trial	120 hours	120 hours
Description of fuel used	Small slack	Small slack.
Price of fuel used.	About 4s. ($1) per ton at pit.	About 4s. ($1) per ton at pit
Fuel consumed per hour	700 lbs.	885 lbs.
Temperature in flue (average)	680° Fahr	831° Fahr.
Temperature of feed water	161° Fahr.	161° Fahr.
Steam pressure	80 lbs.	80 lbs.
Water evaporated per hour	4,372 lbs.	6,916 lbs.
Water evaporated per pound of fuel from and at 212° Fahr.	6.72 lbs.	8.48 lbs.

It is interesting in connection with these tests to notice that at the Leeds Electricity Works, where the record, according to "Lightning," is held for the lowest cost of coal per unit sold, sprinkling stokers are used.

Economizers.—Probably of all the adjuncts to a boiler none is more used or better known than the economizer. The author thinks he is right in saying that there is hardly an electric lighting station in the kingdom where an economizer has not been installed. The economizer, consisting as it does of a bundle of tubes placed in the flue leading from the boiler to the chimney, is simplicity itself. Fitted, as they generally are, with mechanical cleaners, the maintenance is very small; the repairs are, or ought to be, few—in fact, except for its very apparent advantages, it might be installed, set to work, and then be completely forgotten. The only point to be taken into consideration before installing an economizer is the question of the temperature of the flue gases. Should the temperature of the gases leaving the boiler be not more than 400° Fahr. (but, as a rule, they are nearer 600° Fahr.), an economizer would be practically useless. The economy due to the use of a good economizer may be put down at from 10 to 15 per cent. of the fuel burned, according to the temperature of the gases escaping from the furnaces. About the only precaution to take is not to pump cold water through the economizer, as then there is a risk of excessive external corrosion. This is a trifling point, though, and easily got over by running the exhaust of one of the auxiliary engines into the feed-water tank. Where no arrangements for condensing are made an economical way of heating the feed water is by passing it through some form of exhaust feed heater. Considerable economy is experienced, the feed water being raised to about 200° Fahr. when a fair load is on the engines.

Superheating. — While superheaters may be classed as adjuncts to the boiler, the economies are noticed in the engine. The advantage to the boiler is that its duty is lightened. The advantages of superheating are very real, and the superheater has come, and come to stay. The few difficulties in the way of their general adoption are being rapidly overcome. Knowing, as we do, that a small degree of superheat only slightly in excess of the heat in saturated steam produces a disproportionately large beneficial effect, there ought to be some good reason for superheaters not being more generally adopted. In 1870, when superheating was practically dropped, the reasons were apparent. At that time they had no suitable lubricant, and large superheaters, placed as they generally were in the uptake of the flue, were liable to become overheated and become a source of danger. Both these difficulties have been got over now, and the author is inclined to agree with the writer who attributed the non-adoption of superheaters to the fact that "the design of engines had been so cut that any step in the direction of the almost unknown was useless and unprofitable."

Forced Draft.—In studying the economical generation of steam the effect of forced draft must not be neglected. In most cases one hears of enormous savings in boilers under forced draft against those without, but one never hears of any debit for inducing this draft. Steam, say at 120 pounds pressure (the author is now talking of forced drafts induced by steam jets) wastes away at a wonderful rate through the very small orifices in use. In dealing with the smoke question forced draft will undoubtedly be worth very careful consideration, and in suitable places, where coal and coke dust can be obtained at a nominal price, be simply invaluable. In fact, the use of this fuel is impossible without a forced draft. To station engineers, with the present unsatisfactory load curves, the question of the adoption of the forced draft is particularly interesting. Very large demands for steam are made for a very short period of the twenty-four hours. It will, therefore, be generally found desirable to keep the number of boilers down and force them for the short period referred to, even if at that time one does not get the full duty from the fuel burned. One of the best means of adopting forced draft is to have a fan forcing air into the stokehold, and leaving the only passage out through the furnaces. This plan has been adopted in many boats, and there is no reason why some modification might not be adopted in our boiler houses on land.

At West Ham the author has joined with the borough engineer, who is erecting a large sewerage pumping station, in having a joint boiler-house. As he will always have to be prepared to put his storm-water pumps into action, and will consequently have boilers for that purpose under steam, it may fairly be expected that the electricity department will have very little to pay for the generation of steam during the greater part of each day throughout each year. It may be of interest to you to know the temporary arrangements we are now making for generating steam before the boiler-house and shaft are complete. We have laid down two boilers (out of nine) farthest away from the shaft. These two boilers are fixed permanently. When the main flue is to be continued a damper is put in. At the end of the flue a small engine and fan and wrought iron shaft are erected. If this arrangement is to be used for some time, we shall heat the air in the tubes at the back end of the boiler, and then pass it through the fire, through the fan, to the iron shaft. We shall thus get a good draft, no smoke, and the total cost of the temporary arrangement will be only £400 ($2,000). The building of the main flue and shaft can be continued, and when all is complete the damper can be withdrawn, and the engine and fan and the iron shaft removed. In connection with this the following test made by Messrs. Allen, Son & Co., Bedford, to whom the author is indebted for showing him a similar plant at their works, is of interest:

TEST.

Babcock & Wilcox boilers. Induced draft, with arrangements for heating air supplied to furnaces by means of waste gases.

Duration of Experiment.—Fire lit at 3:15 P. M., Wednesday, November 25, 1896. Fires drawn at 2 P. M., Saturday, November 28, 1896. Actual number of working hours, 32¾.

Coal Used.—Waynes' Merthyr.

All the coal used included in the following results, viz., the coal used in getting up steam and banking fires on Wednesday, Thursday and Friday nights, is included with that actually used for steam purposes.

Feed Water.—Feed water heated from 49° Fahr. to an average temperature during experiment of 137.2° Fahr. by exhaust steam from fan engine. Kennedy's water meter used.

Mean pressure of steam during experiment, 176.3 pounds above atmosphere.

Water evaporated per 1 lb. of coal at 176.3 above atmosphere ..... = 9.64 lb.

Water evaporated per 1 lb. of coal from and at 212° Fahr. ..... = 10.91 lb.

Percentage of ash..... 12.5 per cent.

Water evaporated per 1 lb. of combustible matter at 176.3 lb. above atmosphere. ..... = 11 lb.

Average temperature of escaping gases in fan chamber ..... = 378° Fahr.

Average temperature of atmosphere in stokehole... = 57.9° Fahr.

Average temperature of air supplied to furnaces..... = 157° Fahr.
The ashpit doors were kept closed except while removing ashes.
Average vacuum above fire-bars, as measured in fan chamber..... = 1.95 in. water

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Transporting Heavy Masses without the Use of Wheeled Vehicles.

BY W. F. DURFEE, C. AND M. E.

In the attack of fortified places the ability to move artillery and ammunition rapidly to the front is of the first importance; but oftentimes in rough countries, or when roads have been made mere strips of mud by heavy rains, it has not been found possible to employ wheeled vehicles for the transit of siege guns and their belongings, and even the movement of light artillery has been prevented. It is manifest that such a state of affairs might prove fatal to a successful prosecution of the siege, and could not fail to seriously retard it.

Let us see if it is not quite possible, by simple means, that can always be employed—where large bodies of men are available—to move artillery and supplies over roads and territory on which wheel conveyance would be quite out of the question.

The careful reading of history is quite as important for the engineer and soldier as for the scholar and politician. The ancient methods of attaining mechanical ends were often of the greatest ingenuity and efficiency, and are still quite practicable for use under many conditions liable to arise in civil and military undertakings. If we turn the leaves of the story of ancient nations we find that the employment of the "stone-drag" or "stone-boat" is older than the Pyramids, and that enormous masses of sculptured stone were drawn on sledges by a vast number of men, the soil being lubricated by water or oil in advance of the sledge. The ponderous bulks moved in this way by the ancient Egyptians and Assyrians far exceeded the weight of the heaviest siege guns of modern times.

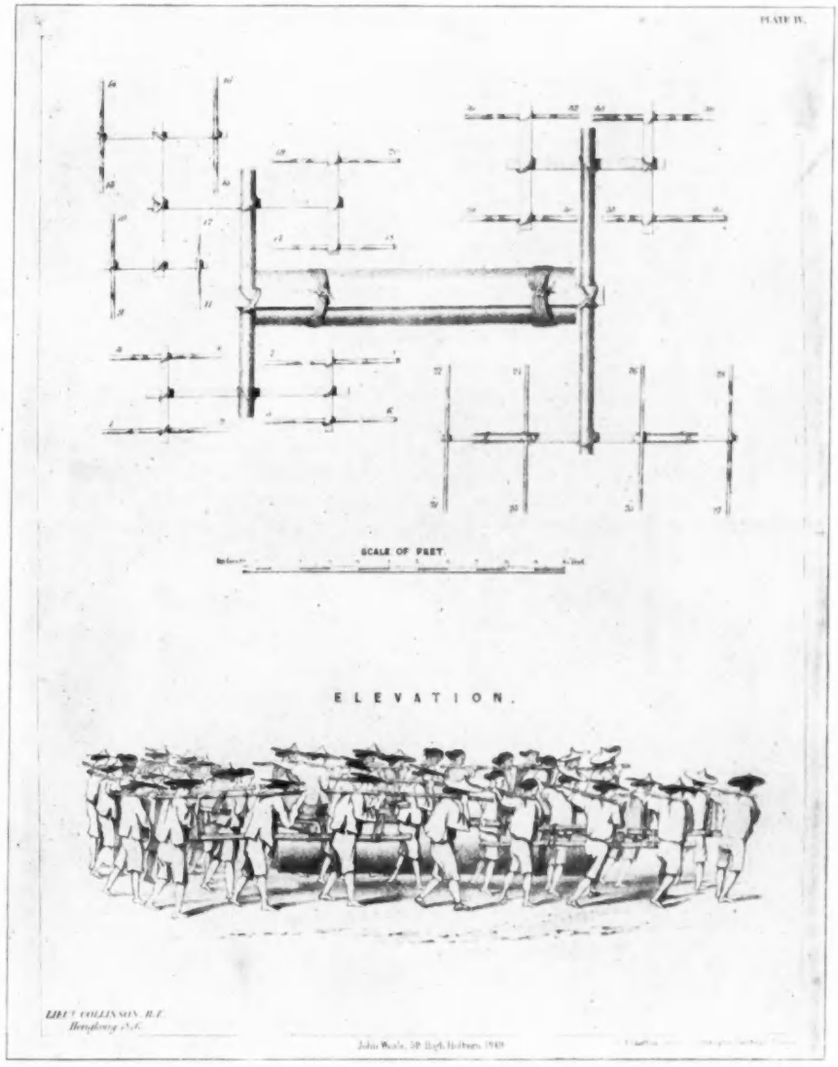
The use of sledges, instead of wheel vehicles, has been common in some towns of Holland from their earliest days to the present, for carrying heavy loads, their progress being facilitated by a greased "mop" or "swab" that is thrown from time to time in front of the sledge for lubricating its runners. Napoleon carried the cannon that subsequently thundered at Marengo and Arcola over the Alps in sledges made of hollowed logs, drawn by men. Massive columns have been incased in timber and plank and then rolled from the quarry to their future location; but for one of the most ingenious, simple, and—where abundance of human help is at hand—effective modes of transporting heavy masses we are indebted to the Chinese. The method referred to was used in the construction of some buildings at Hong Kong in 1845-6. We are under obligation to Major Edward Aldrich, R. E., for a description of this Chinese way of transporting heavy objects. Major Aldrich says:

"At this station, all land transport for the ordnance buildings, for every description of article, has been performed solely by manual labor. * * * Nearly all the large logs of timber used by me in the public buildings, and 462 large granite columns, were carried by manual labor, and the columns fixed in their positions on the buildings. * * * Plate IV., in plan and sketch, describes the Chinese mode, by manual labor, of carrying one of the heavy granite columns used for the barracks at this station from the quarry to the building. The united power of 36 men was thus applied to carry with ease the columns, each weighing 38½ cwt., for about half a mile in distance. * * * In the same way they were carried up an inclined plane, to the position on the building where they were to be placd.

"This disposition of the short cross-pieces vary, depending upon the number of men to be employed in the transport. In moving, the bearers all keep step, and change step occasionally—at the same time removing the weight from one shoulder to the other.

"At the present day the attention of the world is so engrossed by scientific improvements that the power of manual labor in its simple and single state is lost sight of, and to an extent that we now look upon the Egyptian and Grecian monuments of art with amazement; our busy thoughts are puzzled to describe the mode adopted for their erection, and we almost leave the consideration with the impression that their erection without the application of mechanical powers was impossible.

"The means, however, used in the



TRANSPORTING HEAVY MASSES BY MAN POWER.

transport of heavy weights by the Chinese at this station, on the ordnance buildings, recalls our attention to the power of manual labor in its simple state —to the united strength of men—and to the gigantic power derived by such unity, pointing clearly to the possibility of undertaking even a building in rivalry of the Temple of the Sun at Heliopolis.

"The method I have described of carrying a heavy weight a distance, simply by the application of manual power, I consider might be very advantageously introduced, where mechanical means were not at command, to move with the labor of infantry a portion of a siege equipment over a difficulty in transport required to be overcome."

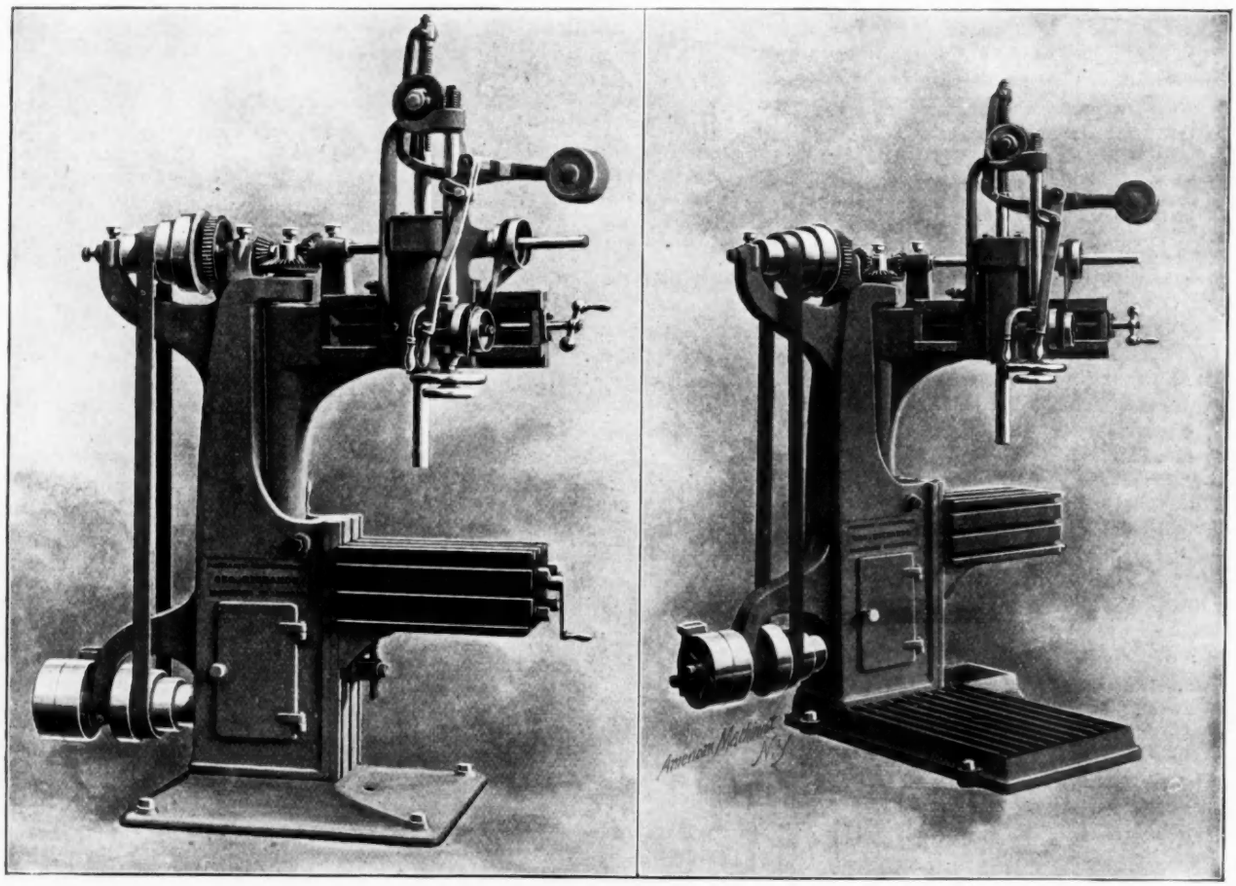
In the accompanying plan the numbered bamboo "carrying sticks" are all equal armed levers, and in fact the whole combination is but a series of equal armed "swingle-tree" levers, which finally transmit and concentrate the lifting power of the men to the two ends of the column; and it will be noted that this combination of levers distributes the load equally among the men, regardless of any variation in their hight and the irregularities of the ground over which they march. The doubling process might evidently be extended indefinitely.

A New Drilling Machine.

The drilling machine illustrated herewith, though it resembles a radial drill and has some of its features, is not intended to be classed as a radial drill, but simply as a drilling machine; but instead of arranging to swing the table upon which the work is placed, it has been thought preferable to swing the spindle and to move it upon the swinging arm.

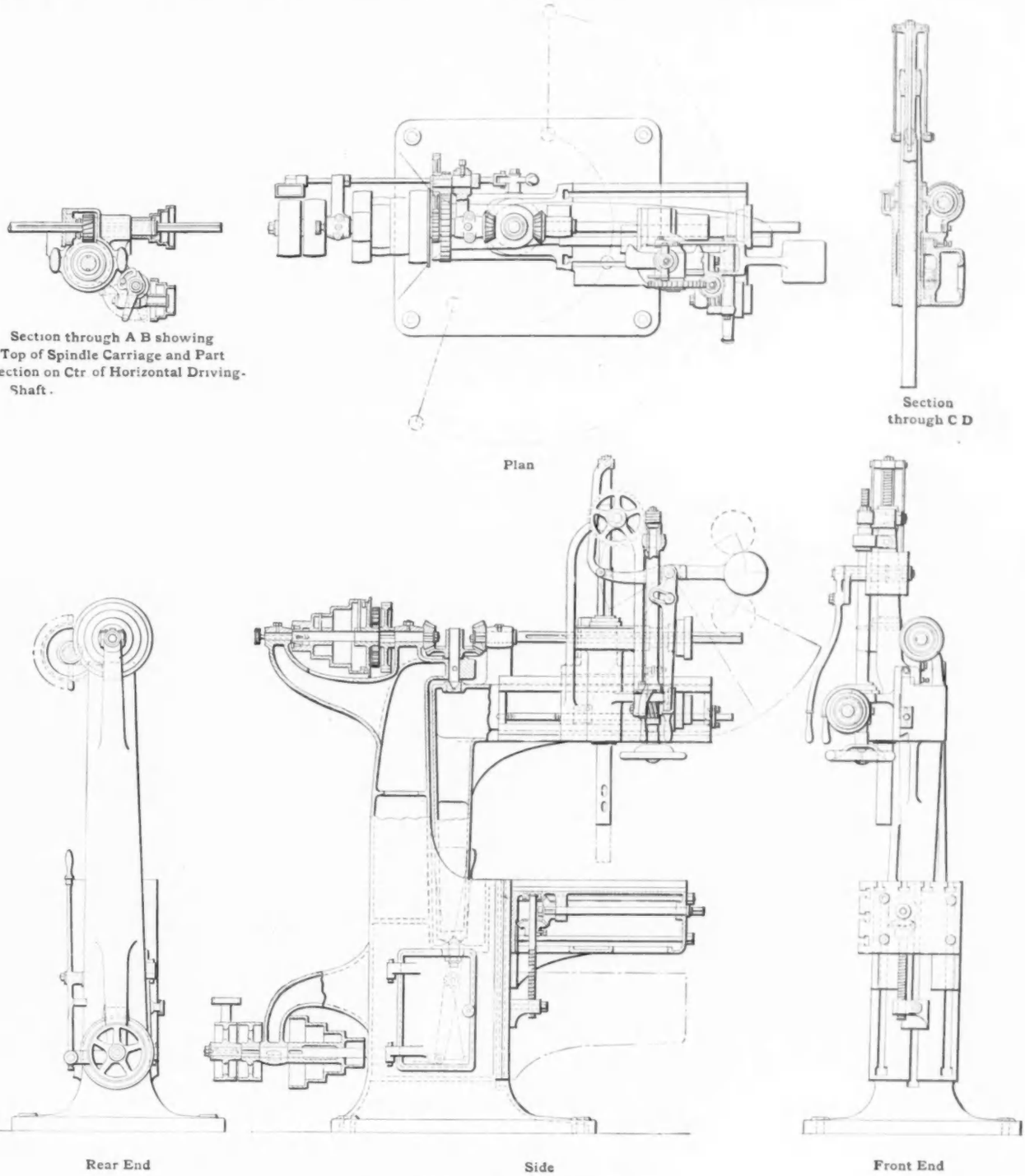
The machine is the design of Mr. George Richards, and he writes that in considering this design he chose the arrangement referred to mainly from consideration of the fact that with the ordinary drilling machine having a circular table supported at the end of a swinging arm the stresses brought upon this swinging arm vary in character, very much depending upon the portion of the table over which the hole to be drilled is located. For instance, if the drill spindle is directly over the center of the plate then the stress upon the arm supporting the table is transverse, but if the spindle be over one edge of the plate then the stress is a combined transverse and torsional one, and the question then arises as to how nearly parallel two holes can be drilled in the same piece when, as sometimes happens, one of these must be drilled near one edge of the table, and the other near the diametrically opposite edge, thus introducing the error arising from the fact that in one case the arm is twisted in one direction, while in the other case it is twisted in the opposite direction. A little consideration will show that the strains caused by drilling are, in the machine illustrated, practically uniform, the table being securely bolted to the upright by four heavy bolts and the swinging arm being of course subjected to the same strain for a given feed resistance.

Reference to the engravings made from photographs and blue prints will make the construction of the machine quite clear, and one of its principal novelties perhaps consists in the fact that the swinging arm turns upon conical pivots or centers similar to those used in the lathe. These are carefully fitted and have their seats in steel bushings inserted for that purpose. They have been adopted, Mr. Richards informs us, from a consideration of the service rendered by centers in turning heavy work in the lathe, and he mentions having seen, for instance, a 110-ton gun running on centers almost continuously for about three months, during a great portion of which time its weight was supported entirely upon centers surprisingly small considering the weight of the piece. Yet these centers gave no trouble, and Mr. Rich-



A NEW DRILLING MACHINE.

ards says he is glad to find that in this drill press they give no trouble, but are entirely satisfactory. Of course the total amount of motion likely to take place in this arm during the life of the machine is small, and in the motion which does take are not subjected to pressure when the arm is being moved. It will be noticed also that the vertical arm of the bell crank lever which constitutes the swinging arm is longer than the horizontal one, the relatively great distance from shaft to the spindle helical gears are used, and the thrust of these gears is taken by ball thrust bearings which have been found to greatly reduce the driving force required and consequently the wear upon these gears.


Section through A B showing Top of Spindle Carriage and Part Section on Ctr of Horizontal Driving-Shaft.
Section through C D
Plan
Rear End
Side
Front End

DETAILS OF DRILLING MACHINE.

place the wear that occurs is upon the opposite sides of the pivots to the sides which come to a bearing during the drilling operation, so that the sides of the centers which are in contact when the arm is lifted up by the drilling actually one pivot to another correspondingly reducing the stress upon the pivots.

The method of driving the machine is clearly shown by the photographs and drawings, and it will be noticed that for the transmission from the horizontal

The machine is built in various sizes, the one shown being capable of drilling at a distance of 2 feet 6 inches from the pivot of the radial arm, having a vertical spindle movement of 9 inches, a traverse upon the arm of 18 inches and a spindle

2 inches diameter. The table is 24 inches long and 14 inches wide, has a vertical face 12 inches high and a vertical adjustment of 12 inches.

It will be noticed that one photograph shows the machine with a slotted base plate attached, and this base plate, which may be furnished or not as desired, is 4 feet long by 2 feet wide. The weight of the machine is 2,800 pounds, and the floor space occupied 7x5 feet. The machine is also made with reversing motion for tapping, and its manufacturers are the Richards Machine Tool Company, Suffolk House, E. C., London, and 102 Rue de Louvain, Brussels, Belgium.

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The French Market for American Goods.

BY F. C. CHAPPEL.

The recent treaty of commerce made between the United States and French Governments does not seem to have given any satisfaction to American manufacturers in France, of whom there are a good many, either directly or indirectly represented.

I have interviewed a good many of the leading houses and they all seem to be unanimous on one point, and it is that the United States Government must get the same terms for American manufactures as have been obtained by Germany, England and various other countries under the "most-favored-nation" clause.

EQUAL RIGHTS FOR AMERICAN MACHINERY WANTED.

One of the largest firms of American importers of tools and hardware said to me: "The very greatest service you could render American machine industries in their relations with France would be to instigate an energetic agitation among America's leading statesmen, through the press or otherwise, by which they would be made to feel how unworthy it is for our country to be treated less favorably in regard to duties than either England or Germany. Every American machine has to pay from 10 to 30 per cent. more duty in France than the same machine made in Germany or England. Cannot our diplomats manage to get us at least equal rights? There is a market here for good American machinery, but the great drawback is the want of better and juster commercial treaties, and until we get fair treatment the trade of America with France (so far as hardware and metal goods are concerned) will remain in the background."

The secretary of the American Chamber of Commerce in Paris tells me that among the American goods that sell well in France are agricultural implements, tools, hardware, machinery and metal goods generally. All of these pay the maximum French tariff rates, whereas if the lower (minimum) rates could be obtained there would be a great increase in business in these lines. The minimum tariff rates, he added, are enjoyed only by nations having treaties of commerce with France. There are many local agents selling American goods and others quite anxious to do business.

To give an instance of the vitality of American trade in France, I may say that French cycle makers have been, and are still, doing all they can to get their Government to raise the duty on American cycles imported into France. They see the business growing larger every year. In 1893 the imports of cycles and parts from the United States were only 150 kilos, whereas in 1897 they amounted to over 100,000 kilos! The French duty on cycles from America is now 250 francs per 100 kilos. (the maximum rate under present treaty conditions), but there was recently a bill before the French Customs Commission to raise the duty to 600 francs per 100 kilos., but the elections interrupted any action, although the question is only temporarily hung up. In other words, the present rate is about $5 per cycle, whereas the increased duty would be about $12. The present rate is not considered too high, and it admits of an enormous business being done, whereas importers claim that the proposed increase would do great injury to the business.

It is thought that the crux of the difficulty, so far as negotiating a treaty of commerce which will give the United States similar advantages with England, is the high tariff which the United States keeps up against France. If the Washington authorities liked to make concessions in this matter it is possible that France would grant reciprocal privileges, although I cannot say that such would be the result, because the tendency in France seems to be toward more protection to native manufactures and greater stringency in maintaining the import duties. One of the chief American houses in Paris dealing in farm implements and general machinery told me recently that "there is hardly any chance for American machinery being placed on the minimum tariff unless the present American customs tariff is considerably changed in favor of France."

To enable your readers to exactly understand the present industrial condition, I give a statistical table showing the growth of the sale of American manufactures in France:

PRINCIPAL EXPORTS OF MANUFACTURES FROM THE UNITED STATES TO FRANCE.

	1892.	1897.
Agricultural implements	$227,692	$644,962
Books, maps, &c.	30,930	44,555
Builders' hardware and tools.	58,995	160,470
Sewing machines	125,700	136,166
Steam engines and other machinery	278,668	.....
Carriages, cars, &c.	.....	46,840
Cycles	.....	283,910
Cotton manufactures	.....	37,000
Instruments for scientific work	.....	225,274
Typewriting machines	.....	95,911
Boots and shoes (exclusive of other leather goods)	.....	22,175
Furniture (exclusive of other wooden manufactures)	.....	229 701

The figures for steam engines and general machinery are not now given in detail, a fact which is to be regretted. One of the most encouraging features of the above table is the number of new lines which America now exports to France; also the steady growth of the established trade in spite of adverse tariff conditions.

The United States ranks about fourth in the importance of its commercial relations with France, the aggregate of imports and exports being exceeded only by those of the United Kingdom, Belgium and Germany. In exports to France the United States is third, and it is only the temporary growth of the Spanish imports of wines that prevents the United States being second, England being first. Although passing events have ruffled the surface, yet the main facts of what Consul-General Morss (Paris) wrote in October, 1896, are as true to-day as they were nearly two years ago. "If," he said, "systematic, intelligent and persistent missionary work is done in France between now (1896) and 1900, when the next world's exposition is to be held in Paris, there is every reason to believe that that event will witness a great triumph for American enterprise. The opportunities now seem especially favorable for pushing American tools, hardware, machinery and mechanical devices of various kinds; electrical appliances, labor-saving contrivances, etc. All novelties in the cycle line, including machinery and tools used in the cycle trade, are eagerly taken up."

In addition to the articles mentioned above, there is a good opening in France for the best pattern and economical steam engines, steam boilers, gas engines, planing and milling machines, lathes, blacksmiths' tools and supplies, steam hammers and punching, shaping and shearing machinery. Also a good cash register, similar to those used in leading United States stores; change receivers, automatic package conveyors, etc. American farm implements are selling well in agricultural parts of France, and a good trade might still be done by newcomers, taking Normandy, for instance, where there are few machines in use for threshing and binding.

Above all, it is no use to write or send trade literature in the English language or to use English weights and measures. The French language must be employed and all calculations and prices worked out on the French system. Your manufacturers must not expect to capture this market in a few weeks or retire from the contest because orders do not come at once. It is just as hard to get business in France as anywhere else, and the people are just as wide awake as they are in New York city.

Paris, August 13.

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In some factories in Germany blotting paper is now regularly supplied to the workmen for wiping machinery.

Letters from Practical Men.

A Counterboring Tool for Screw Machine—Gage for Setting Sprockets.

Editor American Machinist:

I inclose sketch of a bicycle hub counterbore which may be found useful for many other purposes; also a gage we use at the milling machine for the depth of teeth in sprocket wheels.

The counterbore, Fig. 1, as arranged for screw machine, consists of the spindle 1, with shank to fit turret, the front end hardened and ground, after drilling and reaming the end for the counterbore 3, and drilling and tapping for screw to secure same, 4. The female center 2 is hardened, ground and lapped to fit spindle 1, after drilling holes 8 for screwdriver, used in securing counterbore 3, and holes 9, for flooding with oil. The female center 2 has a ball thrust bearing at 5 which is a sliding collar, and at the rear of it is an open helical spring 6 and a fast collar 7.

The hub to be counterbored is held on one end by a wire chuck or by a female center of slight taper. The other end is brought central by the female center 2, which is brought forward by the turret slide until in contact with the hub, when it revolves with the same. The turret is still advanced until the counterbore 3 enters the hub to the depth required, which is regulated by an independent stop on counterbore 3, the helical spring 6 compressing and keeping the female center 2 in contact with the hub. The counterbore will be true, or concentric with the outside of the hub, in every instance.

The arrangement of this device is slightly changed for use on a drill press. The shank of spindle 1 is turned to fit the drill press spindle, and with counterbore 3 revolves with the spindle of the press, and the hub is held stationary by a female center fastened to the drill press table and central with the spindle, and having a large hole in it for the exit of the chips. The female center must be of small taper, about 10° inclusive angle.

This will be found very rapid; much more so than the screw machine, and leaving the screw machine for other work, utilizing a cheaper machine and cheaper help.

The device may be used on a horizontal, double-head machine, using two tools and counterboring both ends at once, using independent stops, some shops having such a machine for various purposes. After counterboring, all the drilling can be done, such as drilling oil holes and spoke holes, before returning the hub to the screw machine for cutting sprocket threads. Some set the screw machine up for counterboring and threading for sprocket at the same setting, but there are only three tools in the turret, and it has to be turned completely around, and under any conditions the drill press is far superior, even with the turret full of counterbores and dies. The spindle can be fitted with any size female center and counterbore for front and rear hubs, but two tools, one for front and one for rear hubs, would do no harm.

Fig. 2 shows the style of counterbore used, showing end view. The fronts of the cutters may be cut on a spiral, giving front rake and giving better results; this was neglected in the drawing.

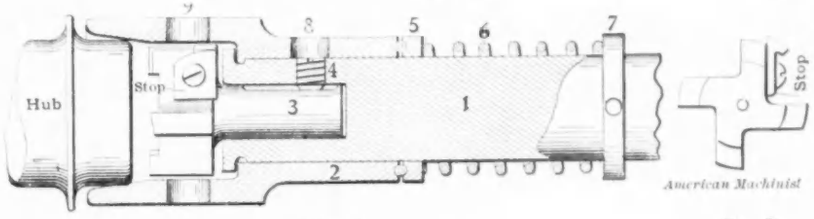

Fig. 1 Fig. 2

COUNTERBORE FOR WHEEL HUBS.

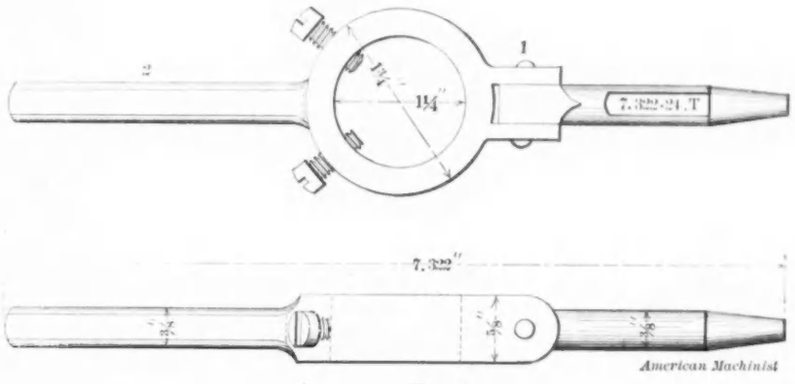

Fig. 3

SPROCKET CUTTER GAGE.

Using a B. & S. sprocket cutter, we find, by consulting a B. & S. table of diameter of sprocket wheels, that a 22-tooth sprocket should be 6.683 inches; 23 tooth, 7.002; 24, 7.322, and so on. Fig. 2 shows the construction of the gage we use. The hole in the center may be varied to suit any sprocket arbor. It is made with a swinging joint at 1, nicely fitted. The end 2 is only put on for the purpose of calipering when grinding, and can be cut off after sizing if not wanted. It is put on the dead center end of the arbor, with the gage pointing straight up, and secured by the two screws. The milling machine table is then raised until the gage just touches the cutter when moved back and forward, being sure to have the most prominent tooth at the lowest point. The gage can be made without the swinging joint, but it is useful in moving the point back and forward, the same as a wire caliper gage on inside calipering.

In the absence of a measuring machine it will be necessary to make some end measures to use in grinding the gages. Having nothing but a 2-inch micrometer, and wanting an end measure for a 22-tooth sprocket 6.683 inches, it will be necessary to make three 2-inch measures and one .683 inch. The common method of making the same is to select a piece of drill rod, about No. 1, cut about 1-32 of an inch longer than 2 inches. Cut three pieces and straighten in good shape; also cut one piece about $^{23}/_{32}$ of an inch. Secure a piece of 1¼-inch round steel, cut off ½ inch, drill and ream a No. 1 hole in the same and face true and cut a slit through one side. There is little need of hardening. File the ends of the measures within .005 inch of 2 inches, and then secure this holder in the vise and file carefully and lap down to face of holder, thus insuring a square end face with small error. Lap both ends and finish to 2 inches by micrometer. The operation will be the same on the short piece, except the length .683 inch. Oilstone the edges of the ends, removing the burrs. Plane a small V groove in a piece of metal, ½x½ inch, or so, and about 8 inches long, and the gages will lie nicely in the V, and you can set the calipers closely to give you the total of measures 6.683 inches with a small error that may be neglected in the diameter of the sprocket. The gages will be a great convenience in any bicycle machine department, and save many a sprocket and a large amount of time in setting up machine for different size

sprockets. There are other kinks for the purpose, but this is the best for all-round service, and admits of the least error.

R. SAFELY.

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Insulating and Accommodating Couplings.

Editor American Machinist:

The coupling shown by Mr. Sangster in your issue of July 21 is evidently a good and sensible one. The most obvious suggestion that anyone is likely to make with regard to it is that it is rather to be regretted that the arms of the driving, or, more properly, the pulling, shaft were not lengthened, as in the sketch, Fig. 1, to make the pull of the straps tangential and reduce the stress on them to the minimum. As the coupling was made, one pattern of course was used for both halves. If the saving in pattern work was the determining factor in the arrangement it was, after all, only what goes on all the while in the average shop. The using of patterns that we happen to have, or, when making patterns, avoiding the making of some that should be made, is always operating to retard improvement or to defeat perfect accomplishment.

Although this coupling is called "flexible," the flexibility is all in the material used, and not at all in the form or arrangement of it. It must still be quite desirable to have the shafts in line and their axes coincident. If the pulling straps were of steel this would be absolutely necessary. Any accommodation that there might be in the coupling, if the shafts were out of concentricity of alignment, would be, after all, in the elasticity of the leather straps. The elasticity of leather is not usually an equal and continuous come and go, but is apt to be more come than go, which would mean permanent elongation, a more acute angle of pull, and consequently increased stress.

While the coupling topic has the floor I venture to send in the sketch of another coupling, Fig. 2, which I saw used just once, and, by the way, it was not then used as a coupling, but was in a model of a device for evading a patent in which a rotary cutter was used and claimed as a part of the patent. The ends of the rods (one end of each rod) were to have a cutter projecting longitudinally, and as the wheels revolved and the cutters came around they would successively cut the material. The device never got into successful use for cutting. The cutting faces would be at a more favorable angle for cutting than the radial faces of the teeth of a milling cutter if the work was fed in the same direction as the cutter, but the angle would be worse than that of the milling cutter if the work was fed against it in the usual way.

The device of course requires no explanation. It is no doubt very old, although I have never seen it described or illustrated. As the flanges revolve, which they will do equally well in either direction, and with either shaft as the driver, the angle of the rods enables them to pass each other. With leather or other flexible straps there would always be two pulling, while if steel rods were used some pushing would be done by those on the other side. Other numbers of rods may be used, changing the angle or the thickness of the rods to give the necessary clearance. The two shafts cannot of course be in the same line, but if the shafts are kept parallel and their centers at the right distance either may be placed anywhere around the circle described from the center of the other. There are doubtless many situations where this device would be useful. There would be no difficulty about making it an insulating coupling if required.

MORRIS FULTON.

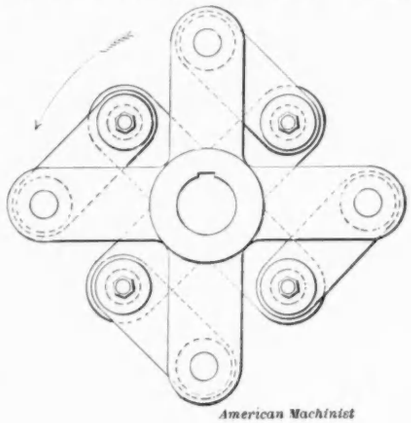

Fig. 1
TANGENT PULL FOR THE INSULATING COUPLING.

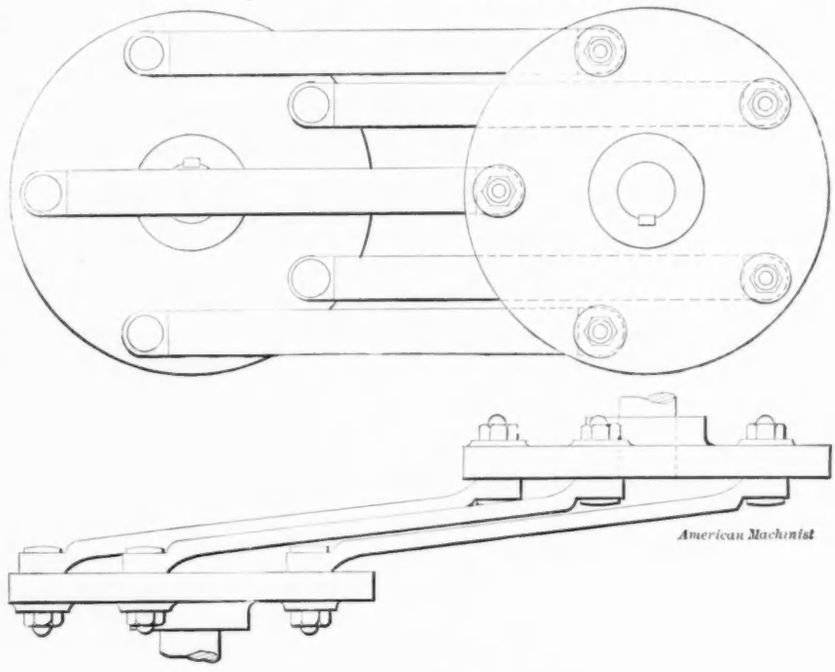

Fig. 2
A FLEXIBLE COUPLING.

Coal Gas Better Than Coal Dust.

Editor American Machinist:

In your esteemed paper, July 28, appeared an article on "Internal Combustion Engines Burning Powdered Fuel." Experiments in this line have already been made by an eminent firm in Europe, but the results have not been such as to make the thing appear practicable. Coal must be ground to extremely fine powder, sifted, cleaned and separated from extraneous, incombustible matter to obtain a complete combustion in the cylinder without residue, otherwise piston and valves become clogged and the engine must soon stop. The machinery for grinding, sifting and separating coal powder and the power required to drive the same are a much more costly affair, and require more attention, than to convert coal into gas in a gas producer and to run the engine by gas.

ALBERT SCHLEGEL.

Milan, Italy.

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An Attachment to the Air Drill.

Editor American Machinist:

We have in use at the Oneonta shops of the D. & H. C. Company one of the rotary pneumatic drills. This is found to be a very useful tool, but its bulk prevents its use in many places where it could otherwise be used to advantage. Both the length of the machine and the length of the handles interfere in confined places and to render the machine useful in such places the attachment shown in the accompanying sketch has been made. The machine is fitted with the usual taper socket, and the shank of the attachment enters this socket, a pin

being inserted at the point shown. The pair of beveled gears supported by the yoke drives the much shorter spindle at right angles to the main spindle, and obviously enables the machine to be used in places where it otherwise would not enter. The feed is accomplished by means of the feed screw and yoke shown in Fig. 2, which are so designed as to occupy as little room as possible. It will be seen that the bottom of the socket is so arranged that the feed screw will engage with the end of the tang on the drill and force it out of the socket. It has been found advisable to furnish two lengths of feed screw for each attachment, in order to provide for holes of different depths. The miter gears are 20 teeth, 8 pitch, and for safety are covered by a shield attached to the frame casting.

WILLIAM NEWTON.

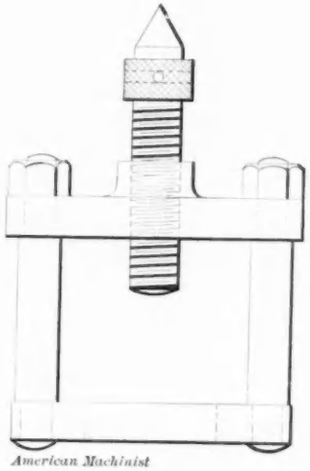

Fig. 2

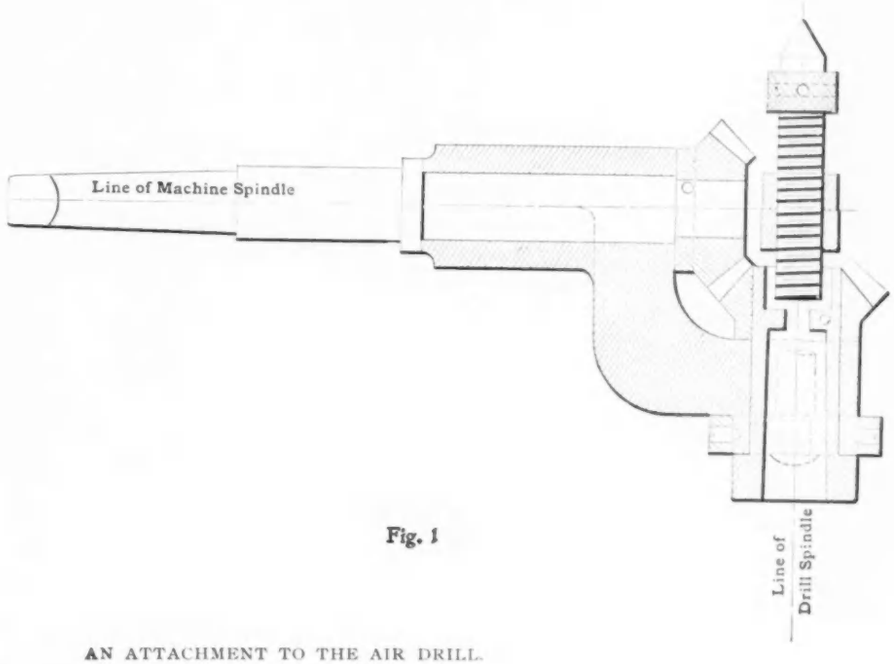

Fig. 1

AN ATTACHMENT TO THE AIR DRILL.

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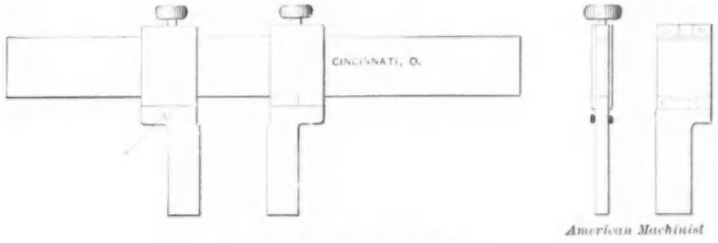
A Planer Caliper.

Editor American Machinist:

I take the liberty of sending you a sketch of a cheap yet good caliper for a planer hand. I say a planer hand, because they generally like this style, on account of its having nice square corners, that allow the trying of a fit sooner than spring or other styles without square corners, and this style is also much stiffer. It was a planer hand at the J. A. Fay & Egan Company's shops that I saw using this caliper, and who said that he made them, having then two pairs.

The sketch will show how simply they are made, and how easy to set. The slides are each made in four pieces, being put together with four small rivets. The jaws are of hardened steel. The fine line on one slide is made just one inch from the small pin on the other slide when the jaws are closed. When setting the caliper it should therefore read one inch more than is wanted. To set the caliper a scale is backed against the pin on the one slide, while the line on the other slide is made to split the line wanted on the scale. With a good scale and a few trials, anyone with a good eye can easily set them within a 1-1000 inch. The small pin can at any time be rubbed off on its side to overcome any wear of the jaws.

HARRY L. CAMERON.



A PLANER CALIPER.

Some Earlier History of the Powder Pneumatic Gun.

Editor American Machinist:

I have seen a description of the Powder Pneumatic Gun in your issue of July 28 and note that it has proved a success. The principle of this gun was, however, patented by B. H. Thwaite (British patent No. 9,791) June 12, 1889, but the arrangement and application by Messrs. Dudley & Sims are different. It is, however, only fair to the original inventor that his name should be associated with a new development which is destined to revolutionize offensive armaments.

F. PLANT.

Westminster, London.

[It is quite possible that the "original" inventor is still further back. Many no doubt have contributed to the development of this, as of other inventions, but usually it is not thought worth while to carry the name of any but the finally successful one.—ED.]

▲ ▲ ▲

An interesting story has to do with the origin of the Root blower. It is stated that this machine was first designed as a water wheel, and that the Root people, who were then manufacturers of woolen goods, put up the money to make the first experimental wheel, which was constructed in a neighboring "foundry." When the machine was finished and was being "limbered up" in the shop by driving it with a belt it was noticed that it sucked in air at one side and blew it out on the other. It was applied to the cupola of the foundry in which it had been built, as a blower, and has been a successful blower ever since.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,

256 Broadway, New York.
JOHN A. HILL, President and Treasurer.
C. A. HANSMANN, Sec'y.

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We invite correspondence on subjects pertaining to machinery.
Name and address must always be given, though not necessarily published.
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Misleading Technical Writing.

"Why does it cost less to run a condensing engine than a non-condensing one with the same machinery running in the factory?" This question, which recently appeared in a contemporary journal, in a specially edited department ostensibly devoted to the conveyance of information concerning steam engineering, would seem to be scarcely necessary to ask in these days, and a reasonably correct answer should not be hard to produce. Of course with the condenser the same volume of steam used in the cylinder gives 10 or 12 pounds greater mean effective pressure for the stroke, the gain in pressure being evidenced by the increased vertical measurements, and consequently increased area of the indicator diagram. To partially offset the increase of mean effective pressure there are to be deducted the power required to work the air-pump, and also the losses attendant upon a lower cylinder temperature, but still a considerable gain of power, or saving of steam, must generally be shown for the condensing engine. The answer to the above question in the columns of our contemporary is verbatim as follows: "Simply because the former develops less total power than the latter. The area of the card will be the same, but the hight above the vacuum line will be less in the former case, and this is what determines the total power developed at a given speed." This is so absurd as to be above the reach of criticism. It has the one virtue of unintelligibility. An illegible sign-post is vastly to be preferred to one that reads clearly and points directly wrong.

In another periodical we find a formally written and signed article of considerable length, discussing the action of steam in the cylinder, which concludes with the following sentence, which is a consistent conclusion from the "argument" which precedes it: "Where the fly-wheel is sufficient in weight and velocity to maintain a perfectly uniform periphery speed, operated by an engine cutting off at any fraction of the stroke, the resistance becomes practically constant, and only the terminal pressure can be estimated as passing into useful work." The maintenance of "a perfectly uniform periphery speed" for the fly-wheel is used in good faith by the writer. The clear and obvious statement then is that, no matter how high the initial steam pressure may be, if it is cut off at such a point that the terminal pressure is that of the atmosphere no power is developed.

The worst of it is that the readers of these publications are expected to absorb all this, and more like it, as bona fide information, with never a hint of its ridiculous character. No explanations and no corrections follow, no matter how outrageous may be the statements or the theories advanced. Many technical journals which do good work and which are all right when attending to their legitimate business, are apt to be all wrong, and at the best worthless, when maintaining departments professing to handle matters which they know nothing about.

We are not skilled in boasting, and have no aim to acquire the art, but we cannot avoid a feeling of satisfaction over our freedom from the easily besetting sin here instanced. We aim to confine ourselves as closely as possible to our chosen and familiar lines. We make mistakes in common with the rest of poor humanity, but we happily have the lively and hearty co-operation of our readers, and any errors that slip into our columns are usually put in the way of correction by the next mail after issue, and often new statements of fact or suggestions of value are brought out in the process.

Tariff Retaliation Again.

On several occasions of late we have remarked upon the tendency toward prohibitory duties against American made machinery in foreign countries, more especially France and Germany, and we publish in another column an article by a contributor who is on the ground and able to state with accuracy the situation as it is in France.

Of course, the contemplated action by the French Government as outlined here, as well as a similar one to be expected by the German Government, outlined in our issue of August 25, is to a degree exasperating to American manufacturers who are affected thereby. In all candor, however, we cannot see that the American people have anything to complain of in the premises. It is simply a case where the sauce which the goose has been compelled to feed on for a great many years is now offered to the gander. We have abundant evidence from numerous interviews with machinery makers to show that a new light is breaking upon them regarding the effects of our traditional position on the tariff question, and we shall be very much surprised if the near future does not see heavy pressure brought to bear upon Congress by the machinery interests looking toward action which will equalize these matters. The great growth in our foreign trade within the past two years shows that in many lines our tariff is a dead letter. It is self-obvious that goods which we can sell under the very nose of the foreign producer, and in spite of adverse tariffs, do not need protection from that producer in the home market; but nevertheless our tariff laws are burdened with duties of this kind which serve no purpose except to excite retaliation on the part of foreign governments. It would seem that the most ardent free traders and protectionists alike could at least agree upon the removal of these duties, whatever they may say and think and however much they may differ regarding duties on goods which we do not now export.

The object of a protective tariff is supposed to be the "protection of infant industries," but when an industry has so far outgrown its swaddling clothes as to be able to compete successfully with foreign producers in their home markets, it is fair to ask what connection the duties have with their original purpose, and when their only effect is to excite retaliation and bring about counter duties abroad, it is certainly hard to see how anyone can defend them.

We fully expect to see a change in our Government's policy in this particular. Regardless of academic discussion of the merits of the general question, and regardless of the party in control, it is not conceivable that our people should thus permit themselves to be perma-

nently handicapped by their own action. "It is a condition not a theory that confronts us."

▲ ▲ ▲

Consolidation of Iron and Steel Companies.

Announcement is made of the consolidation of iron and steel companies into a gigantic aggregation. The companies so far included are:

The Minnesota Iron Company, with its Duluth & Iron Range Railroad, and the Minnesota Steamship Line; the Illinois Steel Company, with its Chicago, Lake Shore & Eastern Railroad; the Southwestern Connellsville Coke Company; the Elgin, Joliet & Eastern Railroad, the Lorain Steel Company, of Lorain, Ohio, and the Johnson Steel Company, of Johnstown, Pa., lately merged into the Lorain Company.

These companies have a capitalization exceeding $75,000,000, and other companies with a capital of over $90,000,000, are expected to come into the combination. These are:

The Cambria Iron Company, Bethlehem Iron Company, Tennessee Coal & Iron Company, Pennsylvania Steel Company, Colorado Fuel & Iron Company and Carnegie Steel Company.

The capital of the new combination will probably be $200,000,000.

▲ ▲ ▲

Commercial Review.

NEW YORK, Saturday Evening, August 27.

THE ENGINE MARKET.

The month now drawing to a close is normally one of the dullest in the year for new contracting to install steam plants, and consequently the number of orders lately placed has not been numerous. There are, however, some indications that the point of greatest quietude has been passed and that trade is tending to rise to its cool weather stage. This is evident more especially in inquires and estimates asked upon engines and boilers than in actual sales. One seller, for instance, while talking conservatively, admits that he has noticed more inquiry in the last five or six days than in three weeks previous. Some concerns have all the office work they can attend to in preparing estimates. Besides fresh inquiry,

(*Continued on page 36.*)

▲ ▲ ▲

Business Specials.

Gear wheels, gear cutting. Grant; see page 18.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Cutters, reamers and small tools, regular and special; vertical millers, cutter and surface grinders shears and punches. R. M. Clough, Tolland, Conn.

For Sale or Rent—Foundry and machine shop with additional land, in good condition and well equipped for medium heavy work; capacity of foundry 7 tons per day; located on railroad within eight miles of New York; terms easy. Call or address J. F. Sweasy, 26 Nassau street, New York.

Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Automatic machinery designer; 6 years' best experience; graduate. Box 185, AMERICAN MACHINIST.

Draftsman wants change; first-class exp. on light aut. and bench machinery. Box 198, AM. MACHINIST.

Foreman, pattern and draftsman; a good, steady, reliable man; good ref. Box 202, AMERICAN MACHINIST.

Mechanic wishes situation with reliable firm as foreman or superintendent toolroom or light machinery. Address Box 193. AMERICAN MACHINIST.

A first-class mach. and draftsman wants position as foreman or assist. supt of machine shop; has held positions as general foreman; best of references furnished. Box 208, AMERICAN MACHINIST.

Wanted—Position as designer of dynamos elect. motors, &c., by two mech. and elect. engineers (graduates of a college in Europe), by Oct. or Nov. 1 if desired; can enter at once. Address, Box 207, AMERICAN MACHINIST.

Wanted—By an experienced mach. and draftsman, a position of responsibility, either in the shop or on the road setting up machinery; has served as general foreman; can furnish first-class references. Box 209, AMERICAN MACHINIST.

Help Wanted.

Wanted—Expert machinists, floor and machine; also expert molders high speed engine work; name, ref. and wages ex. Phoenix Iron Works Co., Meadville, Pa.

Wanted—First-class mechanical draftsman to go to the country; one accustomed to mill work pref.; state age, ref. and salary required. Box 192, AM. MACHINIST.

Wanted—Salesman thoroughly posted in regard to power transmitting machinery. State age, exp., ref. and salary expected, Box 211, AMERICAN MACHINIST.

Foundry foreman wanted to take charge of gray iron foundry, making light bench and floor work; state experience and ref. Address Box 206, AM. MACH.

Machinists wanted—Men with experience to operate Ingersoll milling macnine, 9 foot boring mill and 5 foot lathes and planers. Address the Ball & Wood Company, Elizabeth, N. J.

Planer foreman, 18 years exp. building lathes, planers, radial and multiple drills, &c., wants position; thoroughly familiar with modern methods of turning off work. Box 210, AMERICAN MACHINIST.

Wanted—A first-class die and tool maker on punching, bending and combination dies, jigs and fixtures; must do his own tempering; state experience and wages wanted. Hammar Mfg. Co., Leechburg, Pa.

Wanted—Mechanical draftsman, experienced with steam engines, to go to the country for 4 to 6 weeks; mention salary expected and previous experience. McKiernan Drill Co., 120 Liberty street, New York.

Wanted salesman for high class steam plants, tech. graduate preferred; send outline of experience in designing, selling, erecting and testing out high duty plants; also send full line of references. Address Box 212, AMERICAN MACHINIST.

Wanted immediately an up to date, exp. foreman of machine shop; one accustomed to heavy marine engine work; will consider only first-class man, with satisfactory references. Apply by letter to the Harlan & Hollingsworth Company, Wilmington, Del.

Wanted—Young man as assistant draftsman on boiler, tank and general jobbing work, principally from specifications; rapidity and accuracy more desirable than designing ability. Give age, experience and sal. wanted. Struthers, Wells & Co., Warren, Pa.

Wanted—A thoroughly competent man of exp. to superintend eng. fac.; one prepared to purchase an interest in the bus., which is well estab. and profitable, pref.; must be first-class, up-to-date machinist and understand handling men; a splendid opportunity for the right man. Box 189, AMERICAN MACHINIST.

Wanted—A supt. for a well-established machine tool factory employing about 75 hands; must be a thorough mechanic and able to produce the highest grade work at a competitive cost; a good judge of men and a worker; only those having the necessary qualifications would have any chance to succeed, as the factory is owned and managed by practical mech. Address, giving age, exp., married or single, salary expected and references, Box 205, AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Best Calipers, Levels, etc. E. G. Smith, Columbia, Pa.

Book, Dies & Die Making, $1. J. L. Lucas, Prov., R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Wanted to build small specialty; also dies for metal work. Rankin, New Bedford, Mass.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

One dollar will be paid for copy of THE AMERICAN MACHINIST, issue of June 6, 1895, No. 23. Address Box 196, care of AMERICAN MACHINIST.

We have foundry, pattern and machine shop 175 miles northwest of Chicago, and solicit orders for first-class work at lowest prices. Box 213 AM. MACHINIST.

Wanted—Lathe not less than 94 inch swing; also planer not less than 60 inch between housing, 48 inch high x 16 feet, with two heads; both must be first-class tools. Address Box 194, AMERICAN MACHINIST.

The advertising department of the American Machinist has on hand 20,000 draftsm'n's thumb tacks; will send a box of ten to any draftsman in America on request; could use a postage stamp on box, but will send the tacks anyway.

Institutions retiring from business having machine tools, brass or wood working machinery, will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach Co., 55-59 Woodbridge st., W., Detroit, Mich.

OIL FILTERS

THE BURT MFG. CO., Akron, O., U. S. A.

THE BENTEL & MARGEDANT COMPANY
MANUFACTURERS OF WOODWORKING MACHINERY
HAMILTON, O. U.S.A.

Star Foot Power Lathes

9 and 11 inch Swing.

Screw Cutting Engine Lathes with Automatic Cross Feed, with or without Compound Rest, Friction Countershaft, etc. Contain new and original features especially adapted for Bicycle, Electrical and Accurate Machine Shop Service.

Send for Catalogue B.

Seneca Falls Mfg. Co.,

687 Water St., Seneca Falls, N.Y., U.S.A.

The Inventor of a FLYING MACHINE,

Similar to a velocipede, wishes to correspond with firms regarding disposal of same. Offers should be addressed in German to

P. UNGER, Da Costa Kade 157, III Amsterdam, Holland.

there are some old projects which have been tarrying and which are now advancing to a condition which is expected to culminate in their early fulfillment. These remarks are by no means of universal application, yet they serve as straws to show which way the trade wind tends to blow.

So far for the local sales situation generally, but many of the shops represented in this market are well filled with work, and indeed the names of a few could be mentioned which for a while past have been kept full to the brim, and hence are unable to experience any difference in the level of business. The Ball & Wood Company, for instance, informs us that it was never busier than now; that its works are running on day and night turn and have been doing so right along. In somewhat the same condition is the Watertown Steam Engine Company, which is now working its shop 24 hours a day, and has even had to turn down orders. The Buckeye Engine Company is running on double turn also.

One of the largest engine contracts closed up in some time has just been placed by the Metropolitan Street Railway Company, this city, with the E. P. Allis Company for two more 5,000 horsepower engines to add to several already purchased. They will be installed in the Ninety-sixth street power house.

Local parties have been asked to figure on a plant, of about 500 horse-power, for a large apartment house, about fourteen stories high, on Forty-fifth street and Broadway, in which are to be installed engines, boilers and dynamos of latest type and a cold storage plant.

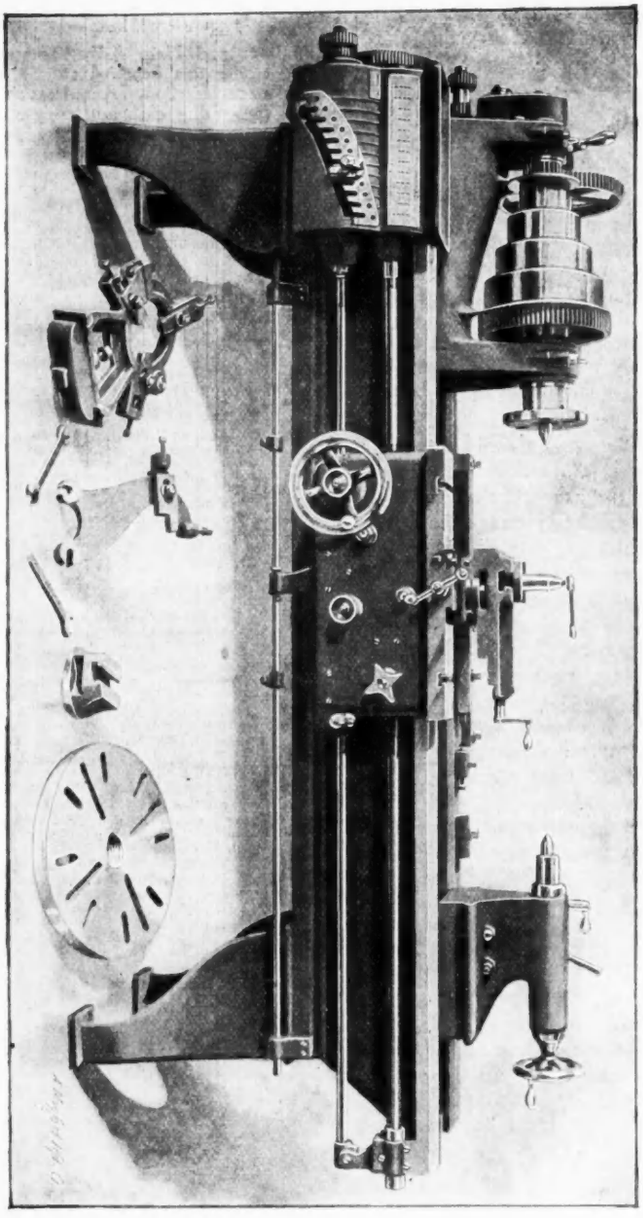
At the local office of the Buffalo Forge Company we are informed that business is excellent and improved since the war. Quite a little is due to the expected erection of large new factories which were delayed because of the war.

One of its latest sales is that of a large valuation of blowers for a smokeless powder works near here.

The Chicago Pneumatic Tool Company writes as follows: "We have just received the second order from the Imperial Chinese Railway covering riveters, hammers and drills, and our president, Mr. J. W. Duntley, is now in New York closing an order for Japan for thirty-six pneumatic tools and three compressors. Our mail to-day covers also many home orders, including one from a navy yard, and the outlook for business is very bright indeed."

H. B. Roelker has shipped to Germany an electrically driven ice machine for the German navy, to be placed on the armored cruiser Fuerst Bismarck.

The Weber Gas & Gasoline Engine Company, Kansas City, Mo., writes: "We are pleased to report business very good. We are well booked with orders and running overtime."



20 in. x 8 ft. Hendey=Norton Lathe.

• • • •

ALL these Lathes have the Norton Screw Cutting feature. All the different threads and feeds in daily use obtained by moving the handle in gear box from one notch to the other. All sizes but the 32 in. fitted with our Automatic Stop Rod for carriage. By its use you can cut threads to and from shoulders and always have the carriage stop in the same place. All lathes have the reverse motion in head, operated by lever at side of apron. By this you reverse the carriage only, which is all that is necessary in cutting threads.

These attachments mean a great saving of time and labor.

THE HENDEY MACHINE CO.,

Torrington, Conn.

AGENTS FOR THE PACIFIC COAST:
PACIFIC TOOL AND SUPPLY CO., . San Francisco, Cal.
J. W. CREGAR, . . Philadelphia Bourse Exhibition.

EUROPEAN AGENTS:
SCHUCHARDT & SCHUTTE, Berlin, Vienna, Brussels.
CHAS. CHURCHILL & CO., Ltd., London and Birmingham, England.
ADOLPHE JANSSENS, ... Paris, France.

Business For Sale.

Controlling interest in well established manufacturing company making patented machinery and hardware; must be sold owing to ill health of owner. Plant perfectly equipped with $30,000 worth of machinery. Business outlook particularly bright. A practical manufacturer wanted who has had experience and who would manage office. Terms easy. Rail and steamboat connections to New York, 75 miles distant. Correspondence solicited.

BOX 797, New Haven, Conn.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

Mark Your Tools with a Steel Stamp.

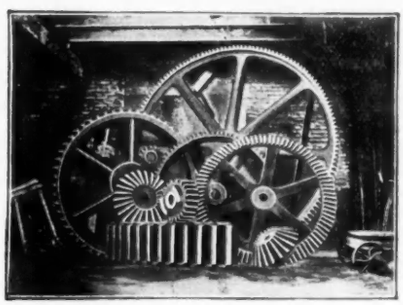
F. A. SACKMANN. 34 PROSPECT ST. CLEVELAND, OHIO.

SEND FOR PRICE LIST No. 4.

T. SHRIVER & CO.,

IRON FOUNDERS,

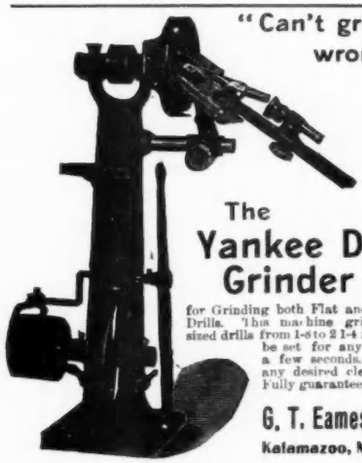
333 East 56th Street, NEW YORK.



GEARS of any pitch, of any face, of any diameter, MACHINE MOLDED.

NO PATTERN NEEDED.

"Can't grind wrong."



The Yankee Drill Grinder

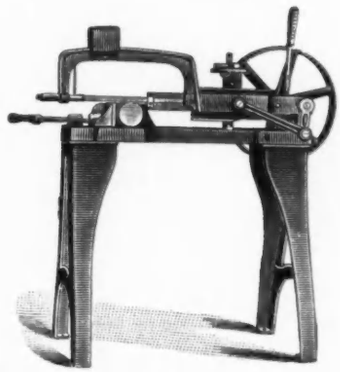
for Grinding both Flat and Twist Drills. This machine grinds all sized drills from 1-8 to 2 1-4 in. Can be set for any size in a few seconds. Gives any desired clearance. Fully guaranteed.

G. T. Eames Co.,

Kalamazoo, Mich.

"The best is as good as any."

The New Automatic and Gravity Feed Q & C Shop Saw



Cuts { Tool Steel, Machinery Steel, Iron, Brass and All Other Metals.

Price—'Way Down.

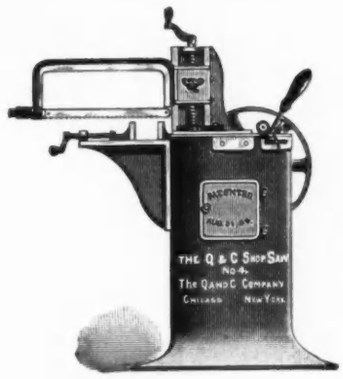
Quality—'Way up.

Shop Saws,

Portable Rail Saws,

Cold Power Saws,

For All Purposes.



Send for Catalogue.

Q & C Company,

Chicago. New York.

LONDON: Chas. Churchill & Co.
PARIS: Hounsfield & Fils.
BERLIN: Schuchardt & Schutte.
MADRID: J. G. Neville & Co.

PITTSBURG REPORT.

The long-looked-for improvement in the iron market seems to have arrived safely, as all branches of trade have taken quite a spurt, and that quite suddenly. The move has been expected and it has brought a decided increase in activity. Higher prices have been predicted for many months past, but owing to the large productive capacity buyers would reach in all directions for figures and secure a low one. But matters have changed lately and material has become quite scarce, and makers are asking figures which are being pretty well adhered to. Bessemer steel has advanced from $10@$10.50 to $10.50@$10.75, while billets, which were selling at $14.50 about a month ago, are being sold at $16.25, with plenty of buyers at this figure.

Other grades of iron have also advanced. Mill iron has gone up rapidly, as well as the different grades of foundry iron. There is more iron now being melted in the Pittsburg district than for some time past. Large sales are reported daily, and sales of small quantities are exceedingly numerous. While the raw iron market has shown great strides, the many allied branches have kept step in the march onward. Parties who have been holding off for a long time in making improvements have felt the improved conditions, and are now making plans for increasing their production. Among the large concerns in this locality having plans prepared are the Shoenberger Steel Company, the Leechburg Foundry & Machine Company and the Shiffler Bridge Company, all of Pittsburg. The first-named company intends to install a rod mill of large capacity. It will be of the Garrett type, to be built by the Garrett-Cromwell Engineering Company, Cleveland, Ohio. Much new machinery will be needed. The Leechburg Company will erect a mammoth plant at Homestead to manufacture all kinds of iron, steel and tin mill machinery, castings, machine molded gearing, etc. As yet no contracts have been awarded, and bids are being received for the equipment. The Shiffler concern will also locate at Homestead, adjoining the new Leechburg plant, and construct a steel building, to be fitted up with the most improved machinery.

The different foundries and machine shops are running fairly well. The Frank-Kneeland Machine Company has just taken a contract to build a large blooming mill for the Lorain (Ohio) Steel Company. It is said that it will be the largest of its kind in the country. The Lewis Foundry & Machine Company has been making heavy shipments of rolls and castings, and has been experiencing a good trade in general. The Fischer Foundry & Machine Company has been making a number of shipments of its engines, both for lighting and power purposes.

(Continued on page 38.)

(*Continued from page 37.*)

CHICAGO MACHINERY MARKET.

In the engine trade the market displays not quite so great a leaning toward the high power grades as it did a few weeks ago. A distinctive gain has been made among the medium sized engines. Usually transactions are not for the equipping of new plants; they are for the refitting of old shops that have for some time been in need of machinery or power rejuvenation, but which procrastinated from year to year and from month to month. The time has come when they can procrastinate no longer. It is common to hear the remark that trade is now back to where it was last spring, just before it took a horizontal drop on account of the war. The outlook is therefore cheerful. Large factors in the engine trade here say that they have under way quite a number of negotiations which may reasonably be expected to develop into business very soon. In fact, trade is already satisfactory in point of volume, and if the margins at which business is conducted were as wide as those of a few years ago contentment would reign throughout the land. With the price of steel advancing an improvement in the prices of engines and boilers is looked for.

The advance in the price of iron and steel seems to be due to a natural demand rather than to the formation of combinations, of which the newspapers have recently been full. The rumored combinations make two large and rival steel interests, one centered in Western Pennsylvania and the other at Chicago. The Pennsylavania interest is said to have secured an option for a plant site at Chicago, and the Chicago interest by report expects to absorb a Lake Erie producing plant, each thus invading the field of the other. Some people surmise that all the present rumors will not eventuate. Incidentally there have been many sales of high power engines among the iron and steel industries of Ohio and Pennsylvania during the past few weeks.

▲ ▲ ▲

Quotations.

NEW YORK, August 29.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 25 @ 11 50
No. 2 foundry, Northern	10 75 @ 11 00
No. 2 plain, Northern	10 25 @ 10 50
Gray forge, Northern	9 75 @ 10 00
No. 1 foundry, Southern	10 75 @ 11 00
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 25 @ 10 50
No. 1 soft, Southern	10 75 @ 11 00
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, Southern	9 50 @ 10 00

Bar Iron—Base—Mill price, in carloads, on dock; Common, 1.05 @ 1.10c.; refined, 1.13 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

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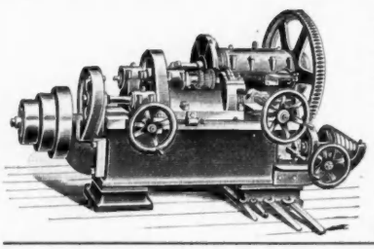

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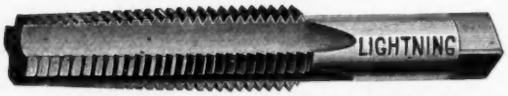

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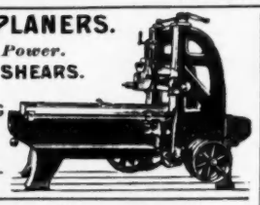

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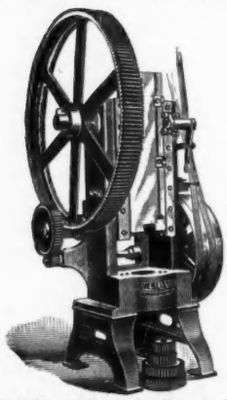

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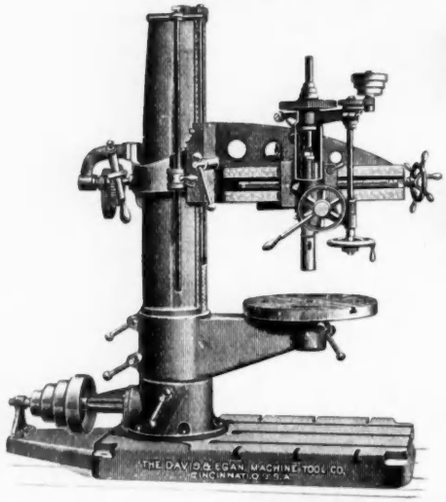

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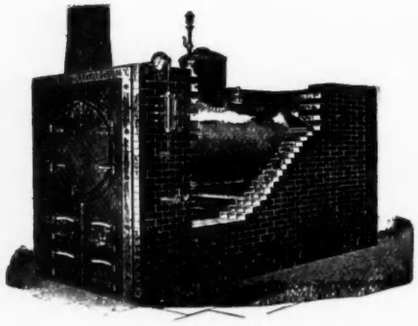

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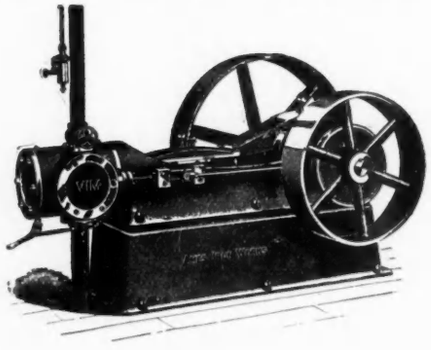

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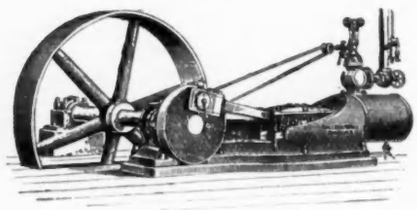

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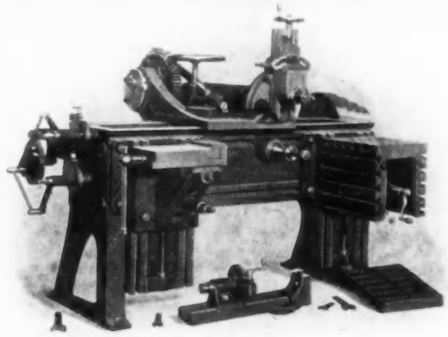

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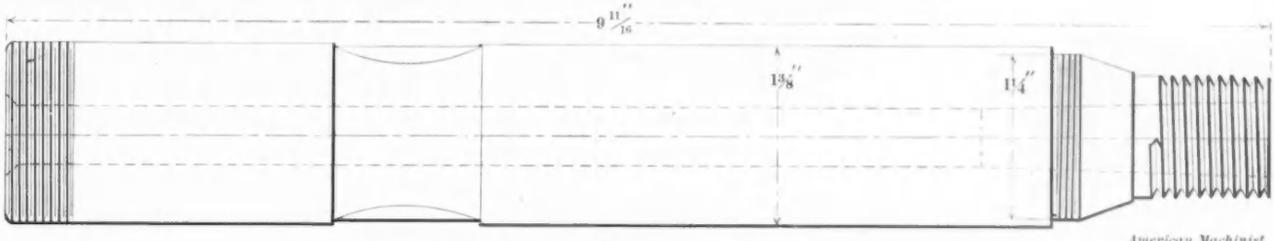

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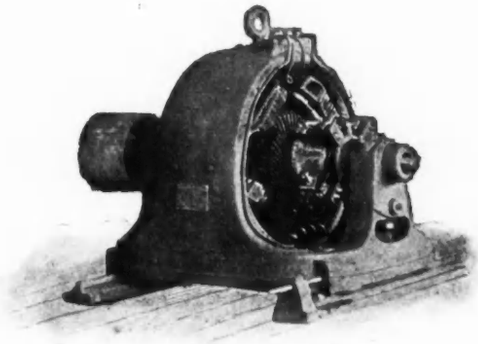

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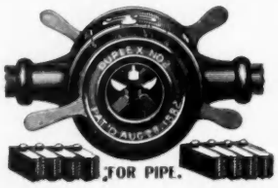

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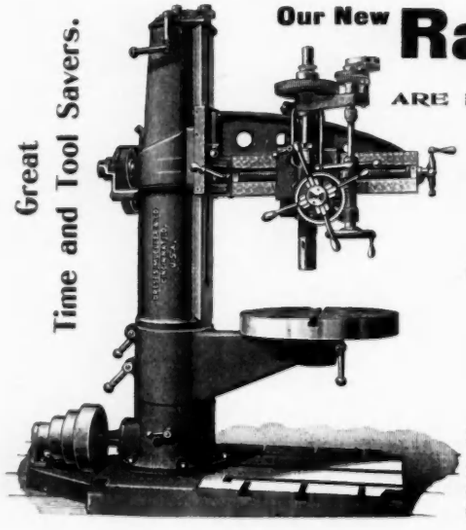

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24 in. x 24 in. x 6 ft. Putnam M. Co., in good order
24 in. x 24 in. x 8 ft. Pratt & Whitney.
22 in. x 20 in. x 5 ft. Pratt & Whitney.
16 in. x 16 in. x 3½ ft. Walters, in fine order.
16 in. x 16 in. x 12 in. Whitcomb crank.

SHAPERS.

32 in. Prentiss friction, all parts.
24 in. Walcott shifting belt.
24 in. Hendey friction.
16 in. Betts, traveling head crank.
15 in. Hendey friction.
12 in. Warren, traveling head.
10 in. Pratt & Whitney crank.

MILLING MACHINES.

No. 2 Newton, Lincoln pattern
No. 2 Pratt & Whitney, Lincoln pattern.
No. 2 Brown & Sharpe, plain.
No. 2 Grant & Bogert, double column, plain.
No. 2 Cincinnati, plain.
No. 3 Garvin Machine Co., hand.
No. 1½ Pratt & Whitney, hand.

DRILLS.

7 ft. New York Steam Engine Co., radial, power lift and half universal.
4 ft. Betts radial, plain, back gears and P. feed.
34 in. Bickford, sliding head, no back gears.
26 in. Prentice Bros., back gears and power feed.
1-spindle Slates, sensitive.
2-spindle Norton, sensitive, power feed.
No. 5 Stow flexible shaft, complete.
No. 4 Stow flexible shaft, complete.

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Style E, Newark horizontal, 5 in. bar, really new.
Style D, Newark horizontal, 4 in. bar, 7 ft. table, has cross feed and can be used for milling, nearly new.
56 in. x 12 ft. Nicholson & Waterman, horizontal, two boring bars.
33 in. N. Y. Steam Engine Co., car wheel borer.

MISCELLANEOUS.

No. 23 Kent punch, 24 in. throat.
No. 3 O. S. drawing press (Stiles & Parker).
Three No. 2. drawing presses (Stiles & Parker).
D73 Ferracute press, 6 in. stroke.
4½ in. x 9 in. stroke, Miles steam hammer.
50 lb. Bradley power hammer.
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One Davis keyseater.
Washburn twist drill grinder.
One ¼ in. Schlenker bolt cutter.
One ½ in. Putnam bolt cutter.
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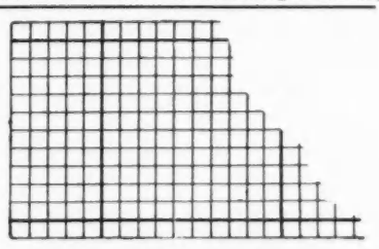

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HORIZONTAL BORING MILLERS—Nicholson, small size; Sellers, medium size.

UPRIGHT BORING AND TURNING MILL—Sellers, 12 ft. swing.

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9 in. x 44 in. Star, contershaft.
11 in. x 5 ft. Prentice plain rest, 6 in. chuck.
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13 in. x 6 ft. Ames, rise and fall rest.
14 in. x 6 ft. Porter.
14 in. x 6 ft. Blaisdell, rise and fall rest, 9 in. chuck.
14 in. x 6 ft. Wright & S., rise and fall rest and 8 in. chuck.
15 in. x 6 ft. Bogert.
15 in. x 6 ft. rise and fall rest, 9 in. comb. chuck.
15 in. x 8 ft. Pratt & Whitney, rise and fall rest.
16 in. x 5 ft. Hand Lathe, 3-4 in. drill chuck, swivel vise, milling attachment, slide rest, extra head for milling.
16 in. x 6 ft. Porter, comp. rest.
16 in. x 6 ft. Blaisdell, rise and fall rest.
16 in. x 8 ft. Pratt & W., rise and fall rest.
2-17 in. x 6 ft. Reed, rise and fall rest.
20 in. x 6 ft. Pond, comp. rest.
26 in. x 10 ft. Blaisdell, comp. rest
26 in. Stevens Pulley Lathe.
50 in. Stevens Pulley Lathe.
2 Lodge & Davis Fox Lathes.

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12 in. x 18 in. x 16 in. Willets.
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36 in. x 30 in. x 8 1-2 ft., maker not known.
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No. 2 Pratt & W., 4-spindle.
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1 4 spindle Ames.
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9-foot Holly Radial Drill.
Hilles & Jones Radial Drill.

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No. 1 Garvin, plain.
No. 2 Garvin, plain.
No. 3 Garvin, plain.
No. 4 Garvin, rack feed, without arm.
No. 11 Garvin, vertical attach.
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No. 2 Becker Vertical Miller.
New No. 15 Brainard Universal.
50 in. Brainerd Keyseater.
Pratt & Whitney Circular Miller.
Niles Power Miller.
Lincoln Miller for sprocket wheels.
No. 2 P. & W. Lincoln.
No. 3 Garvin Lincoln, '94 pat.

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1 21 in. x 6 ft. Flather Turret Lathe, back gears and auto-feed to turret.
1 14 in. Garvin Turret Lathe, with pan.
2 Garvin No. 1, wire feed.
3 Brown & S. No. 1, wire feed.
No. 2 Garvin, wire feed, forming cross slide.
1 Garvin No. 2 1-2 wire feed.
1 No. 2 Pratt & Whitney, plain.
No. 3 Garvin, friction head, 2 jaw chuck.
1 No. 2 Windsor, w. f., chasing bar and tools.
1 No. 4 Warner & Swasey, geared friction head, oil pump and 2 jaw chucks.
2 Pratt & W. Hub Machines, geared friction head, oil pump and 2 jaw chuck.

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18 in. Wood & Light, traverse.
12 in. Crank, Juengst.
15 in. Hendey.
16 in. Gould & Eberhardt.
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13 in. x 6 ft., Ames.
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16 in. x 7 ft., D. & H.
18 in. x 12 ft., Bogart.
27 in. x 12 ft., W. & L.
48 in. x 18 ft., G. & S.

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No. 2 P. & W., plain,
No. 1 C., wire feed.
No. 2 C., wire feed.
No. 2 1-2 P. & W., wire fd.
No. 4 Windsor, plain.
No. 2 Niles.
18 in. P. & W. Chucking Machine

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16 in. x 16 in. x 4 ft., Hendey.
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24 in. x 24 in. x 6 ft., Powell.
26 in. x 26 in. x 5 ft., Powell, with chuck.
30 in. x 30 in. x 8 ft., Smith & Silk.
36 in. x 42 in. x 8 ft., Powell.
36 in. x 36 in. x 18 ft., Sellers.

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9 in. traveling head, Sellers.
13 in. traveling head, Bement.
20 in. G. & E., circular motion.
20 in. G. & E., single geared.

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6-spindle Quint.
Pond Suspension,
No. 3 4-spindle Garvin.
32 in. G. & E., back gear.
34 in. Harris, back gear.
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MISCELLANEOUS.

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No. 5 Water Tool Grinder, Springfield.
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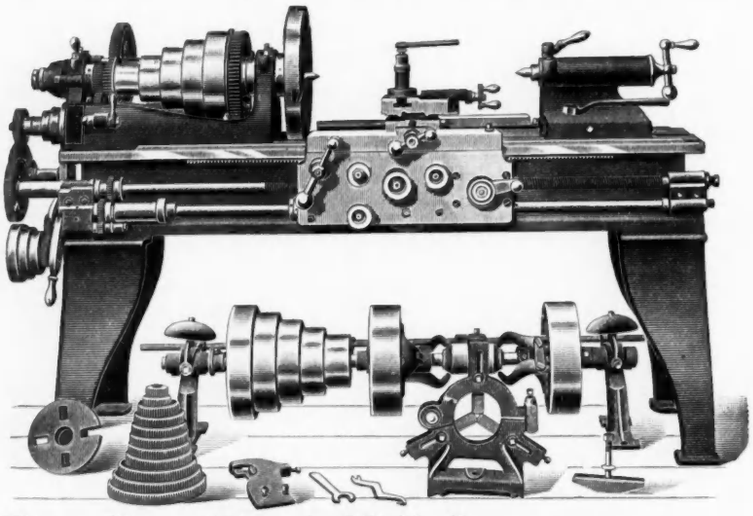

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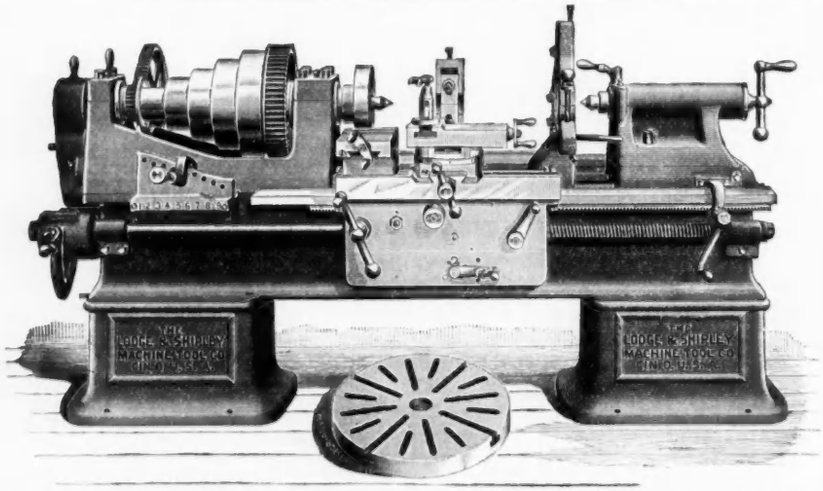

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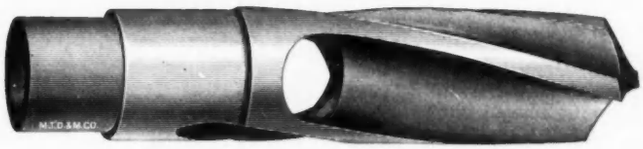

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For Deep Drilling or Long Holes.

These drills have a hole lengthways through the shank, connecting with the grooves of the drill. The shank can be threaded and fitted to a metal tube of such length as may be desired. The tube will admit of the passage of a lubricant to the drill, as also of the cuttings from the drill. These drills are accurately ground on centers.

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For information as to the use of this drill, see illustration between pages 22 and 23 of our 1898 catalogue

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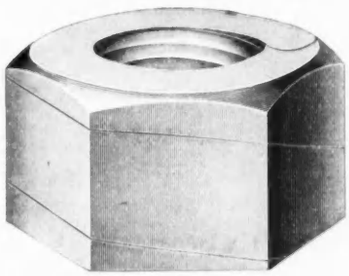

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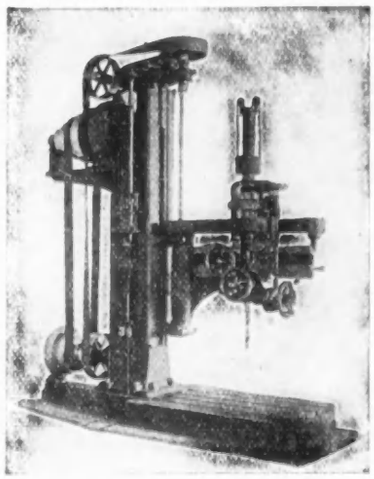

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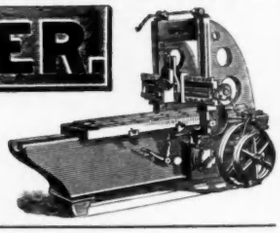

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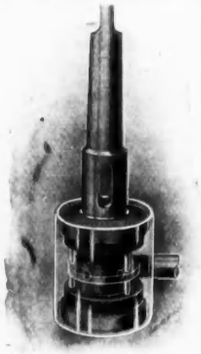

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By the use of these Chucks drills of this type can be used in an ordinary drill press, the lubricant being supplied by a small rotary pump.

The sleeves of these chucks being packed with cupped leather packings are tight and do not leak the lubricant under pressure.

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Made for Nos. 2, 3, 4, 5 Morse Taper. Prices on application.

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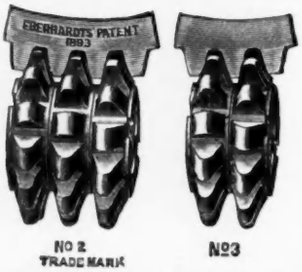

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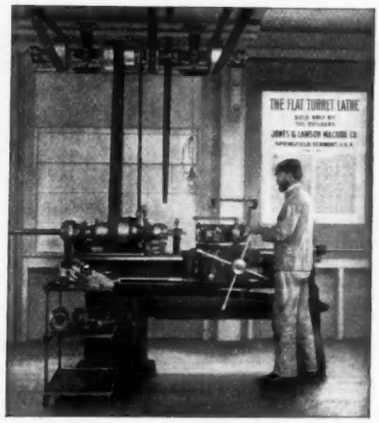

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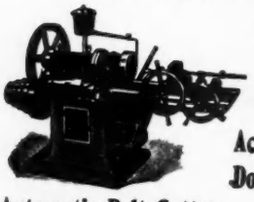

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